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culture

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Pastures for Intensive Fat Lamb . . . . . *J. W. Calder*

Housing Machines . . . . . *M. C. Mathieson*

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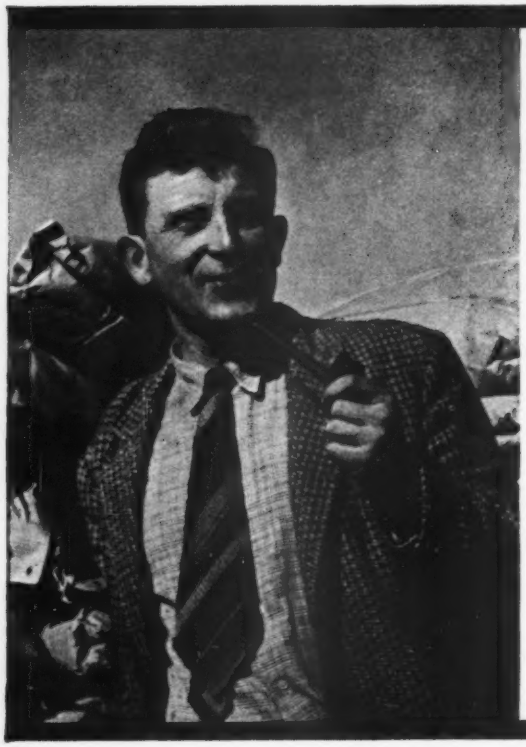

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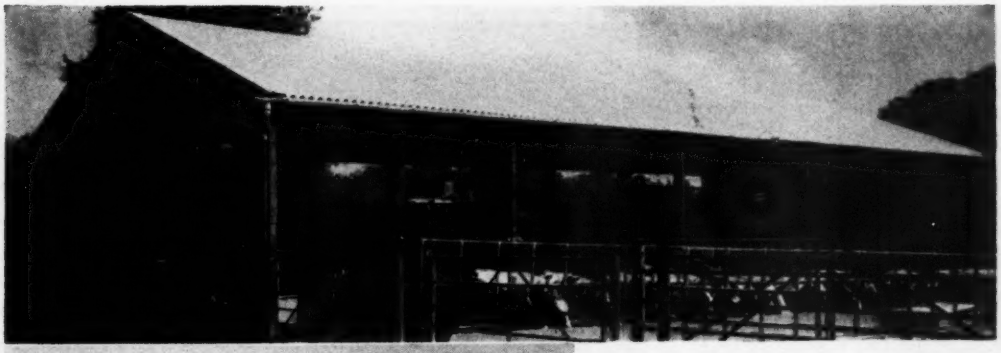

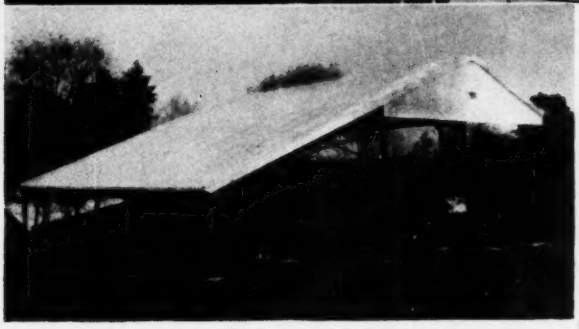

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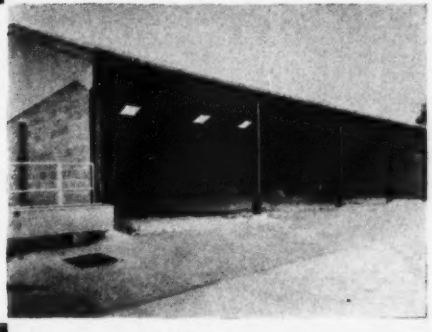

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Agriculture

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Knife points to loose horn at heel

FOOT ROT

A LIMPING sheep? It could be foot rot. This is usually a contagious disease, and because it is contagious the greatest care should be taken to see that suspected pastures are rested from sheep grazing for three weeks. This period is long enough to ensure that the causal bacteria living in the soil have died out, and clean sheep can safely be turned in.

Keep a careful watch for lame animals. If it's foot rot a putrid discharge will usually be found under the wall and sole of the foot.

All affected feet must be cleanly pared to get rid of the diseased horn. Then follow up with a foot-bath or brushing of solutions of 10 per cent formalin. Antibiotics can also be used, but the feet must be thoroughly pared first. Keep the 'patients' away from the rest of the flock and check their progress every three days. After three weeks you can look for a cure, but *make sure* before they rejoin the flock on the 'clean' field.

There is not a single field in Britain today which does not show the gathering momentum of agricultural science

New Thinking in the Farming World

Sir Harold Sanders

Chief Scientific Adviser (Agriculture)

SCIENCE impinges increasingly on the long tradition of farming and many of the mysteries of the art of farming have already yielded their secrets. As knowledge accumulates we are seeing major changes. Little bits of science have in the past been introduced as aids without materially affecting what we have always called 'good husbandry'; but during the past ten years we have reached a position where the scientific aids available have challenged our most cherished beliefs and made it possible to alter the very structure of farming.

Scientists showing us new ways

The chemist with fertilizers and pesticides, the plant breeder with new varieties capable of standing high manuring and resisting pests, and the engineer have, between them, changed the whole face of crop husbandry. The ten principles of rotations seemed, like the Ten Commandments, to be immutable. We ought not, indeed, to forget them, for much of the reasoning behind them still applies—for example, a 'proper' sequence in cropping helps to keep weeds in check. But modern herbicides can do better, even to the extent of getting rid of the lot.

The practical question is whether to be content with partial control as a by-product of rotational cropping or to make a clean sweep and accept the additional expense of a full spraying programme. Hitherto the general

practice has been to have a bit of both, but we have now reached the stage where it appears that we can rely entirely on the controls which science has put into our hands. Eelworms continue to be a threat against which science has no practical defence, and on some land soil structure may be a limitation; in some circumstances, however, the almost sacred principles of rotations may be, indeed are, flouted with impunity.

Continuous cereal growing

Continuous, or nearly continuous, growing of cereals is financially attractive to the arable farmer who is fully mechanized. Barley yields can be maintained at a high level for longer periods than used to be thought possible. It has been known for some time that generous manuring enables the barley plant to stand up to Take-all and other diseases, and pests do not prove decisive. Presumably, when the host crop is grown continually, pathogens build up in the soil; but they have their own troubles which limit their further development.

It is by no means certain, however, that what applies to spring-sown barley is also true for autumn-sown wheat. Indeed, there is some evidence that continuous wheat can only be grown at some sacrifice of yield, though this sacrifice may not be large enough to make the crop unprofitable. The short interval between harvest and the next seeding is probably the important difference. In a long interval the pathogen may be weakened and there is time for a full weathering of the upturned furrow. Soil physicists have shown that weathering produces a good crumb structure which can persist throughout a season.

Mechanized farmers usually make a first-rate job of their cultivations. They do far less than was common in the past, but they are very timely in their work. Root crops that are to be completely mechanized must have an even, fine and firm seedbed, but the early ploughing which is possible for the power farmer gives this with few subsequent cultivations; in a dry spring there is a great gain in that moisture loss is minimized. There are those who argue that the art of cultivation is best forgotten and all that is needed is to scratch the top of the land to get the seed covered. Occasional good crops have been grown with scarcely any preparation, but it is a hazardous procedure. The traditional type of seedbed provides an insurance against weather and biological risks and nowadays it can be obtained by a very few, well-timed cultivations.

Exact, not approximate ideas

Measurement is a characteristic aim of the scientist. A new study can start on a purely descriptive line, but progress is limited until observations can be recorded in figures. We have reached this phase in livestock husbandry. Milk recording has an honourable history, and we have become used to records for laying poultry and for pigs; extension to beef cattle and sheep is already happening. Personal judgment is all very well, and some farmers have it highly developed, but it cannot equal the recording of hard facts.

These are censors of feeding and management and provide a basis for comparisons between systems and between animals kept on one system. With many dairy farmers they have led to considerable economies, and with fattening animals they are essential for purposeful feeding. Once it was considered enough to know that cattle were doing well, but now we need

to know what weight they have reached and what is their rate of liveweight gain, so that their feeding and management can be planned to produce them finished at a predetermined time when prices are likely to be favourable.

Breeding

Records, important as guides to management, are absolutely essential to progressive breeding. The science of genetics is concerned with the chance combination of parental genes, and it is still a long way from being able to influence what actual combination occurs in a particular instance. It is statistical in nature, relying on numbers to show what an animal is likely to pass on to its offspring, its average performance as a parent, with the knowledge that progeny may vary a good bit around that average.

Application of genetics to poultry is relatively simple because large numbers can be bred, unwanted results discarded at little expense, and day-olds are saleable. It is a natural development that poultry breeding is becoming concentrated in the hands of a very few people, who are fully provided with knowledge and facilities for testing large numbers and for collating vast masses of data. It is not so easy with other farm livestock; indeed, it is practically impossible unless a lot of people keep careful and systematic records. For milk, the contemporary comparison method gives assessment of large numbers of bulls, many more than could be evaluated at progeny testing stations; contemporary comparison is, of course, utterly dependent on a well-supported recording scheme. As beef recording establishes itself, similar methods will be possible for evaluating beef bulls. The higher heritabilities of beef characteristics, as compared with milk, provide an alternative method. What the bull himself does is a useful guide to what his offspring will do; hence performance testing is being tried out with beef bulls, and, incidentally, with boars.

High rate and efficiency of liveweight gain are admittedly not all that is required of meat animals, but they are two very important attributes and they can be measured. The value of performance testing must be thoroughly explored, even though it does require feeding, at a high and wasteful level, future sires when they are young.

Revising our ideas on feeding

The science of animal nutrition is advancing steadily, particularly as regards ruminants. Modern precepts lay more stress on the carbohydrate content of a ration and much less on the quality of proteins. We shall soon have to get used to the initials V.F.A. (volatile fatty acids). The various foods produce different proportions between the V.F.A. formed in the rumen, and the optimum proportions vary as between growth, fattening, milk yield and milk composition. Here is another control that science has in the making and it has obvious importance in regard to quality payments for milk.

Then there are new methods for determining digestibility of roughages, methods which do not require feeding the food tested to animals. A routine test-tube method for the quick and accurate assessment of large numbers of samples will give great benefit; advice to the farmer may not have to rely on average digestibilities, but may be on the basis of his own particular lot of hay or silage or, for that matter, the grazing he has to offer.

Stockmanship in the 'sixties

Science is definitely advancing with both the breeding and the feeding of farm animals. At the same time (and the two are connected) there is a trend towards the 'broiler' type of livestock husbandry in which large numbers of animals are kept under standardized conditions. Stockmanship, partly a gift and partly close and continuous observation, has been directed to the individual animal, its likes and dislikes, its comfort and its positive health. Under the new trend stockmanship will be directed to the average and will rely on records of production, measures of temperature, humidity and rate of air change and on the prophylactic needle. These methods are, of course, wholly in the field of science which in the 'sixties will have as fundamental an effect on animal husbandry as it is already having on crop husbandry.

Lettuce Root Aphid

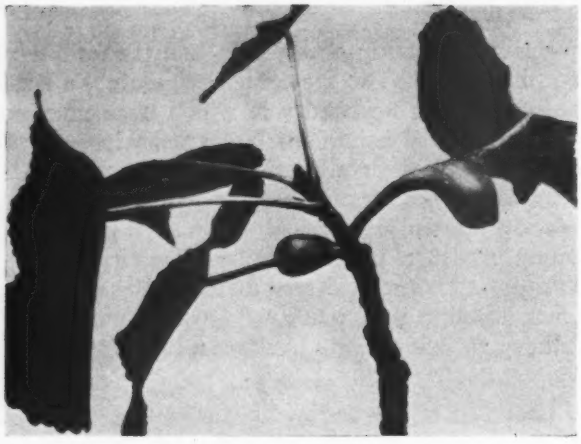
A PEST THAT STRIKES WITHOUT WARNING

J. A. DUNN

UNDER conditions of summer drought, lettuce root aphid (*Pemphigus bursarius* (L.)) can be an extremely damaging pest to lettuce. These conditions are generally predisposed by hot, sunny weather and, at such times, the market demand for lettuce may be high, thus making the economic loss much more evident.

Little warning is usually given of the presence of the pest within a lettuce crop and, although less severely affected lettuces may only be stunted and show yellowing foliage, the first sign, unfortunately, is often the wilting of the attacked plants followed by their collapse and death.

The root systems of these plants will be found to be seething with pinkish-white aphids whose cotton-wool-like wax secretions have given the roots and surrounding soil a characteristic bluish-white, mealy appearance. The wax itself is innocuous—it merely helps to waterproof the aphid; the plant damage arises from the aphid sucking large quantities of root sap in order to feed. The root system becomes impaired and the plant suffers from deficiencies of water and nutrients.



Lettuce root aphid galls, formed in spring on the leaf stalks of Lombardy poplar

Where the pest comes from

The aphid hibernates in the egg stage, well hidden in bark crevices of Lombardy poplar. These eggs hatch when the poplar is breaking bud, usually during the first two weeks of April. The emerging aphids seek out young leaf stalks where they cause the formation of hollow galls, the shape and position of which distinguish them from the galls of other aphids, closely allied to lettuce root aphid. When fully developed a lettuce root aphid gall is approximately flask-shaped and about the size of a cherry stone. The aphid, which has matured within, produces a total of up to 300 young and these become adult in June and July. They are then winged and the gall opens enabling them to fly off to lettuce.

Here they reproduce very rapidly and, if temperatures are high, each winged root aphid can give birth to more than 20 young within an hour of alighting on a lettuce crop.

These young are laid in the form of 'pseudo eggs', generally on the lower leaves of lettuce but sometimes on the ground nearby. In a minute or two they emerge from their investing skins and become very active. They are also so small at this stage that a hand lens is required to observe their movements. Thus entry into the soil through minute hair-like cracks is easily achieved and the young aphids soon settle on the roots of the host plant, to feed, mature and reproduce.

High temperatures favour this development and, in hot, sunny weather, colonies of wingless aphids are quickly built up. In a few weeks several thousand aphids may be present on the roots of each attacked plant and be giving rise to damage symptoms. After mid-August winged forms develop among the root-feeding colonies, usually around the base of the lettuce. These fly back to Lombardy poplar, where their progeny produce the overwintering eggs. A few aphids remain wingless, stay behind in the soil, and can infest subsequent crops of lettuce planted in the same ground during the autumn or following spring.

In Britain, lettuce is the aphid's preferred summer host, but it will also attack endive and chicory. It is interesting to observe, however, that in Holland the aphid prefers endive and is a pest of this crop rather than of lettuce. Besides these cultivated plants, certain weeds, which are botanically allied to them, are also colonized by the aphid. It *does not* colonize grasses,

although the roots of annual meadow grass are frequently attacked by a whitish, mealy aphid of similar appearance to lettuce root aphid and which, in turn, does not colonize lettuce.

What can be done

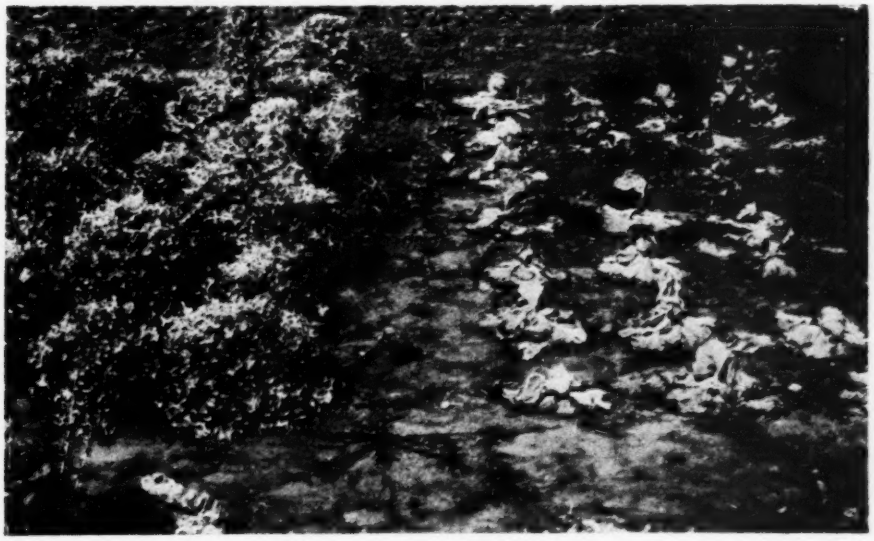
Based on what we know of the life history of the pest, it is possible to adopt precautionary measures to reduce the danger of a root aphid attack.

Because of the importance of Lombardy poplar as the source of the aphid, this tree should not be planted on horticultural holdings. Any Lombardy poplar, already present but serving no obvious screening or sheltering function, should be removed. Where this poplar is used for windbreaks it should be replaced progressively by other species of trees. These could even be another species of poplar, for only the true black poplar (*Populus nigra*) and its varieties, of which Lombardy poplar is the commonest and most favoured, are winter hosts of this aphid.

The carry-over of wingless root aphids in the soil can be overcome if an adequate rotation between lettuce crops is practised. Land which has grown summer lettuce should not be cropped again with lettuce until at least twelve months have elapsed. It should not be cropped with endive or chicory during this period and should be kept free of sowthistles, nipplewort and dandelion. Winter fallow alone fails to eradicate the aphid, for at the lower soil temperatures the pest can survive many months without a host plant and laboratory results show a survival time of more than fifty weeks at 38°F.

The aphid can spread from one lettuce crop to another adjacent, so it is unwise to grow lettuce alongside some already infested with root aphid. This spread is seldom great, however, and can extend only as far as the crawling distance of the wingless forms. All winged root aphids produced from colonies on lettuce, or any of the other summer hosts, cannot themselves colonize lettuce. They are obliged to fly to Lombardy poplar.

Salad Bowl (a leaf lettuce) is resistant to root aphid and no aphids developed on most of its roots (**left**). *Webbs Wonderful is very susceptible and was killed by the thousands of aphids which developed on each root system* (**right**)



The damage caused by a given population of root aphids has been found to be greater on transplanted lettuce than on lettuce sown directly into the field. Summer lettuce, therefore, should be sown in its permanent position and subsequently thinned with as little root disturbance as possible.

The more severe symptoms of root aphid damage can often be prevented, or at least their onset delayed, if the crop is irrigated, since the attacked plants succumb much more readily when the soil is dry than when it is moist.

Resistant varieties

Unfortunately, the varieties of lettuce most widely grown in this country are very susceptible to root aphid attack, but varieties are obtainable which are highly resistant. Two of these resistant varieties, the red foliaged Continuity and the leaf lettuce Salad Bowl, have only a specialized market value, but White Favourite (an All-the-Year-Round type), Midas (an American, White Boston type), Imperial E-4 and Iceberg (a Webb's Wonderful type) should have more general appeal. Where the pest is troublesome, a small sowing of one of these resistant varieties, in addition to the variety usually grown, would soon demonstrate its ability to withstand root aphid attack, and test its local market potential.

The use of insecticides

Chemical control methods are economically impracticable once the aphid is established on lettuce roots. Prevention must be the aim. Thus an aphid attack has to be anticipated and, for this, a pre-sowing soil treatment with diazinon has been found to give a high degree of control.

One pound of actual diazinon per acre (i.e., ½ gallon of 20 per cent emulsifiable solution) appears to be adequate. This can be diluted with water to any convenient application volume between 30 and 50 gallons, sprayed on to the soil surface and rotavated into the top three inches.

Only lettuce likely to be at more than about the sixth-true-leaf-stage over the period when the aphid is migrating from Lombardy poplar need be so treated. In practice, this means any lettuce sown between mid-April and the end of June. Lettuce sown before or after these times are not normally attacked.

J. A. Dunn, M.Sc., Ph.D., is an entomologist at the National Vegetable Research Station, Wellesbourne, Warwickshire. He began working on vegetable pests, especially aphids, at the School of Agriculture, Cambridge, and has continued the work at Wellesbourne since 1959.

J. W. Simpson

Fowl Pest and Vaccination

From 1936 until 31st March, 1963, official policy for dealing with fowl pest (Newcastle disease) was aimed at eradication by a slaughter policy. On 1st April a policy of control by the voluntary use of dead vaccines was introduced in England and Wales and the slaughter of infected flocks, except for the very rare peracute form of the disease, was discontinued. Eradication by slaughter is being continued in Scotland

BOTH live and dead vaccines are used widely against fowl pest throughout the world. The Departmental Committee on Fowl Pest examined the merits and demerits of both before deciding that control should be attempted by the use of dead vaccines, and this conclusion was accepted by the Minister of Agriculture and by the poultry industry.

Live vaccines

Live vaccines are cheap to produce, and they can be administered by mass therapy to birds of all ages, even to day-old chicks if they carry no parental immunity. Usually, mild or attenuated strains of virus are used in their production, and the vaccines operate by setting up a very mild infection. In some circumstances, however, even those prepared from mild viruses can cause illness, mortality, checks in growth rate or in egg production. In other circumstances, without setting up clinical disease, their use may cause stress to the bird and thus precipitate outbreaks of other diseases, particularly those of a respiratory nature. As a result, in some countries where live vaccines have been widely used, and particularly in conditions of intensive husbandy, the poultry industry has quickly been faced with problems of as great or greater economic significance than fowl pest had presented.

Most live vaccines are produced by growing the virus on incubated eggs. Certain bacterial and virus infections of poultry are transmitted through the egg. In this way live vaccines may be contaminated, and their use can lead to the vaccinated flocks becoming infected with the contaminating organism.

Dead vaccines

Most dead vaccines are also produced by growing the virus on egg embryos. The amount of virus produced is measured, steps are taken to kill or inactivate the vaccine by the addition either of beta-propiolactone or

formalin, which also kill contaminating organisms; checks are made to ensure that the inactivation has been effective and the vaccine is then diluted to the required standard before being subjected to potency tests by vaccinating chickens and later submitting them to challenge with a known quantity of virus.

Dead vaccines have several advantages over live vaccines. They do not transmit the disease. They carry no live contaminating organisms and so cannot transmit other diseases. They do not cause stress to the bird and, therefore, do not precipitate outbreaks of infections which may be latent in the flock. Their use does not preclude a return to a policy of eradication by slaughter if at a later date this should be thought appropriate; such a change of policy would not be practicable once live vaccines had been widely used. A given dose of the vaccine is administered individually, thus each bird is known to have received the vaccine; this cannot be guaranteed with the mass therapy methods used in administering live vaccines.

Not everyone is in favour of using dead vaccine. Some of the arguments advanced against it are that dead vaccines are more costly to produce because of the tests to which they have to be submitted and because a larger dose has to be given. Within limits, the dose of a dead vaccine determines the amount of immunity it can set up. A live vaccine, on the other hand, will multiply in the chicken and a smaller dose is, therefore, adequate. Dead vaccines have to be administered individually, whereas live vaccines can be given on a flock basis as aerosols, dusts or as additives to the drinking water. Individual administration increases the cost to the farmer for the labour involved. In general, dead vaccines give a rather shorter immunity than do live vaccines: however, re-vaccination at regular intervals is required, whether live or dead vaccines are used. Dead vaccines cannot be used with full effect until the bird is two to three weeks old.

These disadvantages, however, are considered to be outweighed by the advantages.

Vaccine production and the law

The manufacture for sale and importation of therapeutic substances (which include vaccines) for veterinary purposes is controlled by the Diseases of Animals (Therapeutic Substances) Orders, 1952 and 1953, made under Part II of the Diseases of Animals Act of 1950. Under these orders licences cannot be granted in respect of vaccines which are liable to spread a condition which is a disease for the purpose of the Diseases of Animals Act. Fowl pest is such a disease. For this reason, existing live vaccines for fowl pest are not licensed. In addition to the requirements of the Orders, there are standards for the manufacture and tests for the safety and potency of the dead vaccines which are at present being manufactured or imported for use here.

Visits of inspection are made to laboratories, both at home and abroad, which are manufacturing vaccines for sale in this country. Periodical check tests of vaccines are carried out at the Ministry's Central Veterinary Laboratory at Weybridge.

Proper use of vaccines

Vaccination does not provide absolute protection. No vaccine, live or dead, does. It provides a relative degree of immunity which varies with

A vaccinated bird is a safe bird

(1) the response of the individual (and in young stock this depends on the time of vaccination after birth) and (2) the time after vaccination that exposure to infection takes place. If exposed before immunity has time to develop in 10–20 days after vaccination, the disease will supervene. If exposed a long time after vaccination, immunity may have waned to such an extent that disease may take hold. To prevent this happening the manufacturers' recommended programme for re-vaccination must be followed carefully.

The *whole flock* must be vaccinated. If a part is left undone and becomes infected, it is likely to release virus in such quantities as to overcome the protection which the vaccinated portion has.

If the policy is to have any hope of success, 85–90 per cent of the poultry population must be kept in an immunized state by vaccination. When it is remembered that the annual turnover of poultry is over 200 million, and that all birds being retained for laying must receive at least two vaccinations in their first year, it is clear that the industry as a whole, from broiler tycoon and hatchery concern to backyarder, must play its part fully and conscientiously if it is not to suffer heavy financial loss. Owners must also take all possible precautions to prevent the introduction of infection to their flocks by personnel and equipment, in order to reduce the risk of challenge to the vaccinated stock.

Results of not vaccinating

It is probably not realized in all quarters how seriously and quickly the situation could deteriorate in the absence of a slaughter policy. While slaughter was being practised the great majority of outbreaks were dealt with at an early stage of the disease; only a small portion of the flock was affected and the output of virus correspondingly small. Now, in the absence of vaccination, such cases will run their full course and much more virus will be manufactured and released to infect neighbouring flocks, in which the process will be repeated. In broilers and other young stock the death-rate may well be heavy, and in laying stock a severe check in egg production is to be expected.

The Ministry has field evidence that even if disease becomes established in a vaccinated flock, the vaccine frequently alters the course of the disease

favourably and the amount of virus released from the flock appears to be less than it would be if unvaccinated.

Ministry action in England and Wales

To assist control by vaccination, fowl pest in all its forms will remain a notifiable disease and an owner must still notify suspicion of it to the police or to the Ministry. If fowl pest is confirmed, restrictions will be placed on the premises aimed at preventing movements of poultry and equipment, and of restricting the movement of personnel. Restrictions will remain in force until all symptoms of the disease have disappeared from the flock. Restrictions will be extended also to flocks considered to be exposed to risk of infection and will be maintained on them long enough to ascertain whether or not they have picked up the disease. If contact flocks have been adequately vaccinated it may be possible to limit restrictions or, in some cases, even to avoid placing the flocks under restrictions.

If disease becomes prevalent in a district, area restrictions will be imposed. As in the past, these will severely limit movements of poultry within the area. If, however, a flock is vaccinated, this will be taken into account, and certain kinds of movements out of an area (for example, movement of poultry for slaughter) will be considered. The present requirements of the Live Poultry (Restrictions) Order of 1957, which, among other things, prohibits the movement of poultry off premises if there has been a movement on during the preceding 28 days, will continue.

The future

The situation will be reviewed when the new policy has operated for two years, or earlier if this becomes necessary. If, through poor response by poultry-keepers, the vaccination coverage is inadequate and consequently the disease is not brought under control, the only remaining alternative method would be to use live vaccines. Their deficiencies have been pointed out and the control of certain other poultry diseases, which are not at present a major worry, would almost certainly become an urgent problem and a further burden on the industry.

A great deal of work has gone into the preparations for the new policy. The representatives of the industry have faced the problem with reality and have co-operated to the full. Manufacturers, confronted with the urgent need for large supplies of suitable vaccines, the manufacture of which presented problems of expensive and protracted procedure and stringent testing, have not failed. The various branches of the Ministry have made the necessary arrangements for the purchase and testing of vaccines and have made them available throughout the country on the vast scale required to give adequate coverage. The vaccines are available, the success or failure of this great exercise in disease control rests squarely with the industry.

Success can bring great benefits; failure, great losses and hardship.

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Weed Control on Peat Soils

K. V. Cramp

WEEDS are the most serious problem the grower of horticultural crops has to face on peat soils, especially the less mature, light peats. The most common are annual nettle, chickweed, willow weed and fat hen, but there are many others which add to the general problem.

There are several reasons why weeds are such a problem on these soils. In the first place there is a very high weed seed population which germinates readily and to an unusual depth of 3 inches or more under these ideal conditions. The more mature weeds re-root quickly after mechanical cultivations, soon producing seed and starting up the trouble all over again. Some species germinate later in the season when soil temperatures are higher, and these can be a problem in row-crops even though the more common weeds have been controlled.

The most serious aspect of weed control under these conditions is the high labour cost and the inability of the grower to even keep on top of the job in wet weather. Indeed it is not unusual for a crop to have to be ploughed under because it would be uneconomic or impossible to clean it up.

Contact herbicides

Since vegetable crops such as carrots, celery, parsnips, red beet, spinach and lettuce thrive on many of these soils, the quality and quantity of the produce is very high. Naturally, then, the growing of these crops has been considerably extended, and others of less importance are being tried with some success.

This has been made possible by the use of contact herbicides such as mineral oils, cresylic acid, pentachlorophenol and diquat, applied to the weedy soil surface before emergence to kill the first flush of weeds. Unfortunately, under dry conditions only a small proportion of the weeds germinate before crop emergence. The real problem arises after the first rains. Moreover, crops that emerge quickly are through the soil before many of the weeds germinate.

The ability of certain umbelliferous vegetables such as carrots to withstand the application of mineral oils after the seedlings have fully developed their cotyledons has undoubtedly revolutionized the growing of these crops on the peat soils. Provided the more highly refined mineral oils are used at 40–80 gal per acre after the carrots have fully developed their cotyledons and before they reach pencil thickness, no serious after-effects on the crop should occur. But if the less highly refined tractor vaporizing oils are used, they should

not applied before the two-leaf stage. Try them out first on a small area. T.V.O. should never be used on early bunched carrots; and if used on parsnips it should not be applied until after the two-leaf stage. The more highly refined oils can be used, but they are expensive.

Residual herbicides

It is the more recently introduced residual herbicides that could be so useful, but they have given variable results according to weather and soil conditions at the time of application. Peat soils tend to dry out quickly on the surface under windy fen conditions, and they warm up quickly when sunny conditions prevail. The absorbent nature of the dry peat, coupled with high temperatures, is probably responsible for the indifferent results which we get so often with the residuals on these soils.

It is now an accepted fact that the dose of the residual herbicides should be much increased on the highly organic soils if good weed control is to be achieved; and even then, under dry warm conditions, the result may be disappointing. As an example, in one instance under very dry warm conditions as much as 16¾ lb per acre of chlorpropham (à i) applied to a carrot crop on a fluffy light peat failed to give a satisfactory control of weeds, but in the same season, on a mature medium peat and under cooler and moister conditions, 2 lb per acre (à i) of the same material applied to an onion crop gave very satisfactory results.

Other residual herbicides such as simazine, monuron and combinations of chlorpropham with diuron and fenuron have given just as variable results on these soils when applied to asparagus beds.

Help by rotavating

In an attempt to obtain a better control of weeds with the residual herbicides on the light fen peats, the Eastern Region of the N.A.A.S. tried out in 1961 the effects of spraying the soil with the herbicide and rotavating it in to a depth of an inch or so before drilling the seed. This method consistently improved weed control in crops of carrots, onions, lettuce and red beet, with little ill-effect on the vegetable seedlings.

A further trial in 1962 confirmed these results, when a number of residual herbicides at doses ranging from very low to very high were applied by the logarithmic sprayer and then rotavated in to a depth of a inch or so before the crops were sown. Crops tested out included lettuce, carrot, red beet and onion. Weed control and damage to the crops varied considerably with the herbicides used, the concentration and the crop concerned. Generally speaking, with chlorpropham or materials based on it the weed control was satisfactory and crop damage was negligible. Onions, in particular, stood up extremely well to most materials applied at reasonable doses, but carrots were more sensitive. This method of applying residuals to these difficult soils has aroused a lot of interest and deserves further trial so that recommendations can be made.

Another possibility of improving weed control on the light peats might be by the use of overhead irrigation before spraying with the residual herbicides to ensure a moist surface layer, and this is being tried out.

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Work at NORTH WYKE shows that grassland fertilizer costs can be kept down if there's clover in the sward

Making the most of Clover

J. A. Bancroft-Wilson

WITH the increased use of fertilizer nitrogen and, recently, the greater popularity of the Italian ryegrass ley, the value of clover in heavily fertilized, highly productive pastures has been questioned. A lot of research work has been concentrated on this problem of late, and at one of our youngest research centres, North Wyke Experimental Station, the place of clover in the grass sward has been the main subject of study.

This Station, which is situated on heavy clay in central Devon, is the grassland centre of Levington Research Station. Its forty-inch rainfall is typical of large areas in the west and north. Additionally, trials are extended to commercial farms in other districts, including the light soil, low rainfall parent Station of Levington.

Clover itself does not respond to fertilizer nitrogen; neither does fertilizer have any lethal effect on clover. But nitrogen will increase the vigour of the grasses in the sward. Unless management of the grassland favours the clover, clover suppression will occur, owing to competition for light. Adequate stocking is the key to good management of clover; if the stock numbers can be matched to the keep available, fertilizer nitrogen can be used to push up the productivity of grassland, with the clover still making a valuable contribution to the nitrogen supply.

How much N can clover supply?

The amount of nitrogen which the clover in a good mixed sward will supply depends on the climate. In this country it can vary between 100 and 250 units per acre in one season. Under most conditions it is unlikely to exceed 150 units and in dry districts, such as eastern England, it may well be much less, especially on the lighter soils. The main limiting factors are rainfall and temperature. Comparisons between this country and New Zealand must take account of the much more favourable conditions to be found there.

This is specially true of the North Island, where most of the comparisons with Britain are made. In New Zealand, clover will grow for as long as ten months of the year; in Britain five to six months is more usual.

Nitrogen is transferred from the clover to the grasses partly underground, but mainly via the grazing animal. The amount transferred increases as the season wears on and, with continuous grazing, it is considerable by the latter part of the season. When the sward is cut this transfer of nitrogen is much less, hence the need for higher rates of fertilizer nitrogen when the sward is cut rather than grazed. In some districts, such as those in low rainfall areas, the climate is less suitable for active clover growth. Here fertilizers must be relied on for most of the nitrogen which the crops need.

Fertilizer nitrogen on the mixed sward

The restricted growing season of clover limits the amount of herbage it is possible to obtain in this country from a mixed sward receiving no fertilizer nitrogen. The first and most obvious reason for applying nitrogen is to extend the grazing season, and an early application of nitrogen will generally increase the rate of growth in the spring. Quantities in the region of 40–60 units of nitrogen applied in February or March will not result in any reduction in the clover population so long as the growth is grazed off quickly, but higher rates have been found in experiments to depress the mid-season growth. A similar application in early August will increase the keep available for autumn grazing when the clover is no longer active.

The North Wyke experiments have shown that a moderate dressing of nitrogen in May can increase midsummer production to a very worthwhile degree on well-managed swards which are intended for grazing. Midseason applications of nitrogen are more difficult to manage, since the clover is growing actively and can easily be suppressed, but if the herbage is kept well under control, the clover will continue to make a valuable contribution.

When fields are cut for hay or silage some suppression of the clover is almost inevitable. For good yields a fairly high rate of nitrogen must be applied—40 to 60 units for hay and at least 60 units for silage. When the crop has been removed, hard grazing will help the clover to recover, and this can often be accomplished quite quickly. If quick regrowth and further grazing is needed, more nitrogen may be applied after the hay has been removed.

To obtain yields from all-grass leys comparable with those from a good mixed sward, high rates of nitrogen have to be applied—at least 200 units per acre. This makes the herbage relatively expensive. In districts where clover thrives, the all-grass sward can be justified only for very intensive systems of farming, particularly intensive dairying, and the provision of early bite. Work at North Wyke, supported by research workers elsewhere, has shown that to get the most from the nitrogen, growth periods should be as long as possible. This will mean grazing at a fairly mature stage, certainly longer herbage than one would graze on a grass/clover sward, or using this type of ley mainly for cutting.

Three farming systems

Systems of grassland management can be divided broadly into three types. It must be emphasized that more than one system will apply to any one farm, some fields (generally those nearest the premises) being farmed more intensively than those further away. In the first system the nitrogen supply is

North Wyke Experimental Station

drawn mainly from the clover, though some fields may receive fertilizer nitrogen in spring for early bite, or in autumn for late bite. This system is limited by the capacity of the clover to produce nitrogen and must be confined to areas where clover thrives. Nevertheless, under the right conditions, it can be quite productive and is ideally suited to the more extensive forms of grassland farming, such as the traditional systems of grass fattening of beef and rearing dairy followers which do not justify heavy expenditure.

In the second system the aim is to obtain the highest output commensurate with retaining the clover. Generally, three nitrogen applications will be made —in early spring, late spring and late summer. The total quantity can be in the region of 100–150 units per acre in good clover districts, but in drier areas 80 units may be a more suitable amount. This system is ideally suited to most dairy herds where fairly high stocking rates can be achieved. It could also apply to intensive beef and sheep production.

The third and potentially highest yielding, but most expensive, system is based on the all-grass sward. It is most useful for fields for very early grazing and where production is mainly intended for mowing rather than grazing. Where it is not possible to grow clover because of limitations of soil and climate and there is no alternative available for grazing, the herbage should be grazed at a later stage of growth than is usual practice. For high yields at least 200–250 units of nitrogen must be applied.

Phosphate and potash rates depend on nitrogen

While this article is concerned mainly with the need for nitrogen, farmers generally recognize that both phosphate and potash must be applied in adequate quantities if the returns from nitrogen are to come up to expectations. Experiments carried out at North Wyke and on commercial farms in other districts have shown that the amount of phosphate to apply is determined by the level of herbage production; the more grass produced, the more phosphate required. Once any initial soil deficiency has been corrected, 40 units of phosphate a year is adequate where nitrogen is entirely from clover.

A further increase in the phosphate rate is justified only where fertilizer nitrogen is applied. As a general guide, an extra 30 units of phosphate will be required for each 100 units of fertilizer nitrogen.

Phosphate requirements have been shown to be the same whether the sward is cut or grazed, at least in the short term. Potash, on the other hand, is depleted much more quickly when the grass is mown, so that the quantity required will vary. If the field is mainly grazed, with only an occasional cut, potash requirements will be similar to those described for phosphate. But if to be cut continuously, much more potash will be needed.

Little and often

As both phosphate and potash requirements are determined largely by the amount of nitrogen available, it is convenient to apply all three nutrients in several small doses rather than in one large annual application. Indeed, it has been clearly demonstrated that large potash applications are wasteful, as they lead to 'luxury' consumption when the herbage takes up more than it needs. This is a wasteful practice. Moreover, as it increases the amount of potash in the herbage, it can also increase the risk of hypomagnesaemia.

Exceptions to the 'little and often' rule are when correcting an initial deficiency or on a clovery pasture which is to receive little or no nitrogen; in these circumstances a three-yearly dressing of basic slag or a small annual application of a PK compound is sound practice.

In spite of the increase in the use of fertilizer nitrogen on grassland, clover is still important as a means of keeping down grassland fertilizer costs. By careful management and adequate stocking, high yields can be obtained from grass/clover mixtures, which for most systems of farming are more profitable than the alternative of the all-grass sward.

Before becoming Agricultural Liaison Manager to Fisons Fertilizers Ltd., the author of this article, **J. A. Bancroft-Wilson, M.A. (Cantab.)**, served in the National Agricultural Advisory Service for six years. He was previously a member of Cambridge University Farm Economics Branch.

Bringing Back the Acres

Ironstone

W. Morley Davies

Of the 400 acres being taken out of agricultural use each year for ironstone extraction, it is estimated that more than 95 per cent is returned sooner or later to farming or forestry. Such a high return exceeds that of any other extractive industry except opencast coal. This is due firstly to the traditional practice, from early times, of restoring the land; and secondly, to the effect of the Town and Country Planning Act, 1947, under which the ironstone companies are required wherever possible to carry out restoration work. Another important inducement is provided by the Restoration Fund established under the Mineral Workings Act, 1951, and financed by contributions from the ironstone companies, the royalty owners and the Exchequer. The companies may draw on the Fund if the cost of restoration exeeds a fixed amount; and landowners and occupiers may obtain assistance from it to meet abnormal costs of managing and cultivating the restored land. These measures have been effective in preventing the workings from becoming derelict.

Since 1947 proposals to open new workings have been subject to the grant of planning permission and usually to conditions requiring the operators to restore the land and make it reasonably fit for agriculture. A large area has been restored in accordance with these planning conditions.

Of the area worked before the passing of the 1947 Act, a large acreage was restored to agriculture in accordance with the terms of the leases. But in an area of about 3,400 acres, where deeper seams of ore were worked, restoration was at that time considered impracticable and the workings were left unlevelled in the condition known as 'hill and dale'. About a thousand acres of this unlevelled area were successfully planted with trees. With the passing of the Mineral Workings Act in 1951, it became possible to reclaim the remainder of the unlevelled 'hill and dale'. Helped by payments made

from the Ironstone Restoration Fund, the local planning authorities, and at some sites the ironstone companies, have levelled almost the whole of this derelict area; and although there was no topsoil to provide a surface layer, the owners and occupiers are now bringing it back into agricultural production.

Although the farming of this land is difficult, the progress made so far has been encouraging, and great credit is due to the local planning authorities and to the owners and occupiers for a notable achievement. As with land restored in accordance with planning conditions, the owners and occupiers are helped by the Restoration Fund to meet abnormal expenditure on capital equipment, drainage, cultivations, seeds and fertilizers.

All ironstone production is in the hands of a few large companies and is mainly confined to the East Midlands (Northants, Rutland, Leicestershire, Lincolnshire, Oxfordshire and the Soke of Peterborough).

The geological beds from which it comes are: the Northampton Sands of the Inferior Oolite, the Marlstones of the Middle Lias and the Frodingham Ironstone of the Lower Lias.

Except for deep mining in one or two localities, the ore is now being won by opencast methods. The speedy working by modern machinery inevitably leaves the overburden in hill and dale and this must be levelled before the previously stripped top soil can be replaced.

Types of soil

The original nature of the cultivated soils overlying the ironstone largely determines the nature of the farming problems likely to arise when they are replaced. In texture, they vary from sands such as are found on the Northampton Sands to clays derived from the Chalky Boulder or Estuarine Clays. The remnants of shattered limestone beds in the replaced overburden and soil are often a considerable handicap to the farmer. Hand-picking, about the only way it can be cleared, is expensive. Stone-picking machines have been tried, but so far without success. Often the land has to be left sown down to grass.

On soils derived from the Northampton Sands there is usually no serious problem, apart from the presence of stone. Soil structure, in general, is maintained and normal cultivations are possible after restoration. Unfortunately, yields are only fair, and drought or heavy rain raises difficulties, the former by burning and the latter by pans. More than the usual amounts of fertilizers are required. Root crops are not satisfactory.

On the boulder clays, panning is often serious, due to the surface compaction following the use of heavy machinery for levelling. This is even worse where Estuarine Beds have been mixed with the clay. Even when topsoil is replaced, these are not easily managed, but without topsoil they are very difficult. Because of the stones present, disced implements are more satisfactory than the conventional tools.

The problems associated with farming on restored ironstone land sites have, to some extent, been cleared up by a series of experiments started about 1941 by Dr. William Davies and R. M. Deakins, and later continued by the N.A.A.S. at Colsterworth, Roxby and Weldon. No similar experiments have so far been conducted on areas which have been restored with topsoil since it doesn't seem necessary in view of the wealth of experience coming from practising farmers.

Most of the land, it was assumed, would be sown down to grass, and accordingly the crops tried out have been mainly grasses and legumes. Of these, the legumes are the most satisfactory, lucerne in particular. As lucerne does not readily fit into the pattern of farming nowadays, grass/clover seeds mixtures occupy 90 per cent of the restored grassland areas. Crops grown on these subsoil materials are slow starting, particularly after rain; there is a strong likelihood of waterlogging. Even after germination, the grass is slow in establishing itself.

Fertilizers and lime

Although lime is necessary in a few cases the pH is usually satisfactory. Phosphates are almost invariably needed in large dressings, to obtain vigorous growth—a point of particular importance in Northamptonshire. Potash is not particularly necessary unless the dressings of the other plant nutrients are high. Nitrogen is essential on all sites, light or heavy, and grassland especially requires regular dressings. A suitable seedbed fertilizer for grassland could be:

60 units per acre of nitrogen (N), equivalent to 3 cwt per acre sulphate of ammonia
96 units per acre of phosphate (P_2O_5), equivalent to 5 cwt per acre superphosphate
60 units per acre of potash (K_2O), equivalent to 1 cwt per acre of muriate of potash

Alternatively 6 cwt per acre of a 10:15:10 compound fertilizer could be used.

This should be followed by a similar dressing in the second year. Extra nitrogen may be necessary at the rate of 60 units per acre in mid-season, dependent upon the intensity of use. Basic slag can be used with advantage at intervals after the first year. When lucerne is sown, satisfactory establishment can be achieved only when a small application of nitrogen is given in addition to phosphate and potash. A suitable fertilizer treatment per acre would be 40 units of nitrogen, 108 units of phosphate and 120 units of potash; or 8 cwt per acre of a 6:15:15 compound fertilizer may be given.

Seeds mixtures

When some topsoil is present, however thin, a much better sward, especially in the early stages, is assured. A vigorous root system is essential to build up the structure of all these soils, and its effects are particularly marked on clays. As regards seeds mixtures, the farmer will be well advised to consult the D.A.O., who has knowledge of the requirements of this particular class of land. Meanwhile general types of mixtures, such as the following, will give good results:

For Mowing (*lb per acre*): 16 Lucerne; 3 S.37 Cocksfoot.

Grazing		**Alternatively**	
lb per acre		*lb per acre*	
5	S.23 Perennial ryegrass	2	S.22 Italian ryegrass
5	S.24 Perennial ryegrass	10	S.48 Timothy
3	S.22 Italian ryegrass	8	Meadow fescue
2	S.37 Cocksfoot	either 3	Wild white clover
6	Danish meadow grass	or 2	S.100 White clover
2	N.Z. white clover	1	N.Z. wild white clover
1	Wild white clover	½	Trefoil
24		23–23½	

Management

The Soil Survey of England and Wales found no bias in favour of cutting versus grazing as regards soil development in the early stages of the sward, as is the case on restored opencast coal land. Rather was the bias in favour of grazing, as judged by the incorporation of a small amount of humus in the surface layers, thus starting up the slow process of crumb formation. But a very long time must elapse, perhaps scores of years, before the subsoil surfaces fully assume the nature and characteristics of soil. Meanwhile, the farmer must be prepared to fertilize heavily in order to produce and maintain a vigorous sward, and great care must be taken in stocking to avoid puddling the surface in wet weather.

Arable farming on non-topsoil sites

On heavy, stony surfaces the hazards are almost too great to encourage farming with arable crops in the break. Surface stone-picking and removal of boulders contribute only partially to the solution of the problem. Happily, the stony sites are not typical, and there are other areas where successful restorations have been carried out. At a later stage, heavy rainfall may cause ponding in the depressions.

Impermeability is the great bugbear, and it takes a week of fine weather to dispose of a heavy rainstorm. At harvest time, wet weather can for weeks prevent the use of harvesting machinery, and cereal crops can be a total loss. As well as waterlogging in wet weather, baking in hot weather can be expected.

On lighter soils there is more opportunity for mixed farming, although in the early stages it would be more advantageous to stick to grassland until soil conditions are so far improved that arable crops can be grown profitably. Among the more suitable crops are cereals, oats and barley, sown either in

Ironstone working at Geddington, Northants

autumn or spring. For autumn-sown cereals fertilizer must be applied in the seedbed at the following minimum rates per acre:

30 units nitrogen (N) equivalent to 1½ cwt sulphate of ammonia
72 units phosphate (P_2O_5) equivalent to 4 cwt superphosphate
75 units potash (K_2O) equivalent to 1¼ cwt muriate of potash
or 5 cwt of a 6:15:15 compound fertilizer

Such crops will also need a spring top dressing of 50 units per acre of nitrogen (N) in the form of an ammonia-nitrate fertilizer.

Spring-sown cereals will need a similar supply of fertilizer either applied in two dressings as shown above or all in the seedbed. If the latter course is adopted a dressing of 8 cwt of a 10:10:10 compound fertilizer would be a more convenient alternative.

If in doubt it would be wise to seek advice and to have the soil analysed. Incorporation of farmyard manure proved particularly beneficial in trials carried out on this class of land some years ago.

Farming land which has been topsoiled

A lot of experimental work has been carried out in cropping, manuring and management of non-soiled restorations, but we have less exact information for land where topsoil has been replaced.

Much of the land now being passed back to general farming will have had the benefit of proper topsoil restoration. It has always been said that provided a good standard of management is adopted, restored land having the benefit of sufficient topsoil should present few difficulties. Except where there are many boulders or stones near the surface, no serious difficulties should arise. Again, a high level of farming and management is necessary. One ironstone company now restores the subsoil in addition to the topsoil, explaining that this operation helps to blanket the stony brash in the overburden, thus preventing many of the stones and boulders from rising into the topsoil and interfering with cultivation. Most ordinary crops can be grown profitably.

Here and there special difficulties may occur. One restored site in N. Lincolnshire has a light blown sand on the surface. In parts of the field, so far unworked, rock occurs at a depth of 2 feet and waterlogging is common after rain. The drainage of such a site is clearly very difficult. Some of the pipes have had to be laid in a channel cut from the solid rock.

Subsidence due to old underground workings is a hazard to cultivation since one can never be quite sure when the final subsidence has taken place! Where the land is sufficiently stable, the holes can be filled and there is an excellent instance in Northamptonshire where an enterprising farmer has done this himself in a number of affected fields; but care and experience are necessary to avoid possible dangers.

Work at Great House N.A.A.S. Experimental Husbandry Farm, Rossendale, Lancs, shows that there is much to be said in favour of

Wilting for Silage

C. H. MUDD
Director, Great House E.H.F.

WE heard little about wilting in silage-making until the arrival of the forage harvester, for in the days before this machine was used most of us, of necessity, had to wilt. We generally mowed off a meadow before starting to move the grass, and in the intervening period between cutting and ensiling the crop wilted. But with the coming of the forage harvester, the grass was cut and delivered direct to the trailer, thus speeding up the job and saving one operation and one man. The forage harvester is sometimes blamed for producing poor quality silage—in the same way that the baler was blamed for bad quality hay, but in both cases it is not the machine which is at fault; it is the way in which it is used.

Silage fermentation is a complex process and one which is not yet fully understood. Essentially it is either the suppression of bacterial action by the addition of chemicals or alternatively the encouragement of lactic bacteria (to form lactic acid quickly and so prevent the development of undesirable bacteria). The first method, although popular on the Continent, has not spread widely in this country, due partly to the difficulty of applying acid and partly to the expense of chemicals. Most farmers prefer to encourage the natural evolution of lactic acid. The problem is how?!

Wrong idea

For many years we thought that the lactic bacteria worked best in a warm environment. We used to pay a lot of attention to temperature control, starting making on a Friday so that the bottom layer had time to warm up over the week-end. Thermometers were placed in the silage, and if the temperature remained below 100°F we filled more slowly. Even so, the silage would sometimes come out badly, smelling of butyric acid. The chemists not infrequently reported that the silage was 'underheated', but anyone who had made their silage carefully knew that this was not the case, since it had been checked with a thermometer for warming up. The presence of butyric acid was associated with low-temperature silage, but we now know that this assumption was quite wrong. In fact it has been shown conclusively that the type of bacteria which produce butyric acid cannot live at low temperatures. How did this misconception arise?

I believe it was due simply to the confusion between cause and effect. When the silage was made from very young, lush, wet grass containing a high proportion of protein and very little sugar, it settled down tightly in the silo and air was effectively excluded. In consequence, the temperature was low. This type of grass made poor silage, not because the temperature was low but because it was made from a wet material lacking in sugar—the raw material for lactic acid. On the other hand, if the silage was made from a more mature grass which contained a higher proportion of sugar and then put in dry after wilting, it was difficult to consolidate adequately. Air was trapped in the herbage and the silage warmed up. The finished product was sweet and appetizing, not because it had warmed up but because it originally contained a higher proportion of sugar and it had been wilted.

The beneficial effect of wilting has been recognized for some years, and the reasons for this have been studied by research centres all over the world. The full story has yet to be revealed, and the answer is probably the combination of several factors. Several of the N.A.A.S. experimental husbandry farms have been studying this problem for years, and although we cannot say *why* wilting pays we can say quite categorically that it *does*.

Three years' work at Great House

At Great House E.H.F. we started trials in 1959. Two identical silos, each holding approximately 50 tons, were built with facilities for weighing all the grass going in and all the silage coming out. Temperature was recorded at all points in the silo and the effluent measured. Each year a grass field was divided into a number of equal plots, each about 1–1½ acres. Half the plots were cut and carted direct to the first silo, using a forage harvester; the remainder were cut with a mowing machine and wilted before being picked up with a forage harvester and put into the second silo. In the second year molasses was added to both. In the third year molasses was added to the unwilted silage only.

By filling slowly in the first year we allowed temperatures to rise and found in consequence that the dry matter loss in the unwilted silo was 31 per cent. In subsequent years filling was much quicker, and we managed to keep the temperature of the silage to about 80°F. This increased the feeding value of the silage and resulted in better fermentation.

The beneficial effect of wilting has been demonstrated in every year at Great House and also in most years at Gleadthorpe and Drayton. Wilting reduced the loss of dry matter in the silo so that, in spite of field losses of about 5 per cent, due to respiration and mechanical loss, the total loss in dry matter was on the whole in favour of wilting.

Fermentation of the wilted silage was better than non-molassed and unwilted silage, and the product was as good as unwilted silage to which molasses had been added. The wilted silage also had a higher digestibility than the unwilted material—indicating an improved feeding value.

In the first two years wilted silage had a considerably higher dry matter, for it was wilted for twenty-four hours and consequently the animals ate more of it. Wilting also reduced the effluent to negligible proportions. In the third year, however, the time allowed for wilting was reduced and rain fell whilst silage-making was in progress. In consequence there was little difference in dry matter. In spite of the fact that no molasses had been added to the wilted grass, it was more digestible and the stock ate it with greater relish.

What happens in the wilting process to improve the production of the desirable acids? There are several theories and probably all of them acting together help to improve fermentation. We know that as soon as the crop is cut the proportion of sugar starts to rise, thus providing raw material for quick fermentation. The juices also become more concentrated and provide more readily available food for the bacteria. Laceration also helps this process. Dutch research workers have found that the pressure of the cell sap in the wilted plant inhibits the development of the bacteria which make butyric acid, and this may have a direct effect on the result. For all practical purposes, however, it does not really matter what the reasons are: it is sufficient to know that it works.

What about the snags?

Of course there are snags to wilting, the most obvious being the extra operation of mowing. One's first reaction is that it is bound to increase work, but in fact this is not so. Indeed it has been shown on some farms that the total work is *reduced* by mowing. If two swath-boards are used on a 5-ft mower, a 40-inch forage harvester will pick up a full swath at high speed, thereby avoiding travelling over the whole area with the forage harvester. Some claim that the wilting reduces the weight to be moved from the field, so making transporting time less. In our experience the time taken in carting from the field to the silo is the same for both; although weight is reduced, the volume is much the same and the number of loads is constant whether wilted or not. On uneven land the mowing machine takes a closer cut than the forage harvester and in consequence a heavier crop is sometimes taken. On the other hand, on this type of land there may be some grass that the forage harvester does not pick up cleanly. Sometimes there is difficulty in picking up out of the swath, for the grass tends to wrap around the rotor. This can happen when crossing the swaths, but if the machine is set properly and the swaths followed there should be no trouble.

One of the problems in making wilted silage is to prevent it from warming up through insufficient consolidation. Quick filling and heavy rolling help, and in addition the last few loads should be put on without wilting and the silo sealed with soil, lime or other heavy material to keep out the air.

One of the commonest objections to wilted silage-making is that the weather may break. When not wilting one can choose a time when the grass is dry, but if it lies overnight it may rain and drying in the swath is prolonged. If this does happen we generally apply molasses and continue to fill the silo, but this may not be necessary. I have already mentioned that we ensiled wet wilted grass without molasses in 1961 and fermentation was perfect. In this case very little drying was taking place in the crop, but sugars were increasing and a change in cell sap was taking place. Perhaps this is all that is necessary.

There are two promising machinery developments in wilted silage-making. One is the adaptation of the forage harvester to return the cut grass to the ground and to pick it up with the same machine later. The other is the chopper mounted on the forage harvester, which helps to set up good fermentation and consolidation, and also enables one to move both the cut grass and the finished silage mechanically.

There may be mechanical problems associated with wilted silage-making, but once these are overcome there are no more problems about the animals eating it.

Pastures for Intensive Fat Lamb

J. W. Calder

Low cost intensive fat lamb production can be operated under a wide range of conditions when the basis of the feed for ewes and lambs is grass. But the pastures must be productive and of good quality. They may be short-term leys of Italian ryegrass, the more common three- to four-year leys, a ley persisting for eight to ten years or more, permanent pastures, or a combination of these. The kind of pasture will be influenced by the soil type and climate, the intensity of cropping, the rotation, the size of the farm and the farmer's choice. Whatever the type it must be treated as a crop and managed in such a way that it produces maximum quantities of high quality feed.

So much from good grass

The seasonal growth curve of grass in this country parallels fairly closely the seasonal feed requirements of the fat lamb flock, and it can also provide the greater part of the winter feed for the ewes in the form of hay or silage.

Over the past few years research stations throughout the country, the N.A.A.S. and a few pioneer farmers have demonstrated that modern high-producing pastures are capable of supporting a much greater number of ewes than had previously been thought possible. Their results show that from lambing through to weaning, six or more ewes and their lambs per acre can be carried on good pastures—i.e., for from four to five months during the spring and summer. In addition to this the ewe flock has to be carried for the greater part of the seven or eight months of autumn and winter on a maintenance level. During this time some hay or silage, made from surplus growth during the summer, is fed. For practical purposes it can be taken that about half the total annual growth from pastures is required in the spring and summer by ewes and lambs and half in the longer autumn and winter by the ewes. So when six or eight ewes and their lambs are carried on pastures during the growing season, this works out at around three or four ewes per acre per year on the area devoted to the flock.

The economic unit

Assuming a stocking rate of three to four ewes per acre, an intensive fat lamb enterprise is most efficiently operated when the ewe flock is large enough to make full use of a good shepherd. But of course one often has to operate a part-time unit or multiple units according to the conditions on the particular farm.

In the highly specialized intensive fat lamb enterprises in New Zealand a flock of 800–1,000 ewes is regarded as a one-man unit; but in Britain the number is likely to be much less because of the higher lambing percentage and the higher returns from lamb meat. Besides this, more work is required of the shepherd in this country where there are few contract shearing gangs, few suitable sheep yards for handling larger flocks, where more shepherding is necessary over lambing time and where the winter feeding period is longer than in New Zealand. A flock of 300–400 ewes might be considered at the start of a development programme and I would expect the flock to be increased to 500 ewes and more as the shepherd gains experience with the intensive system, as the pastures improve and as facilities for handling the sheep are provided.

On these two bases then of 3–4 ewes per acre and an economic unit of 300–400 ewes, it will be seen that around 100 acres of high-producing pastures will be needed. Knowing the gross cash return from a fat lamb producing ewe, including a lamb and a third, plus wool, it is easy to compare the gross return from modern pastures with the return from a corn crop. Pasture does not come off too badly.

So we should allow around 100 acres of high-producing pastures, preferably arranged in well-fenced fields of 10–15 acres, in order to fit an intensive fat lamb enterprise as an economic unit into our farming systems. The plan will vary according to the size of the farm, the kind and number of other enterprises and the choice of the farmer. We must leave the farmer to work out his own plan so long as he provides about 100 acres of good pasture which, as I have said, can vary from the one-year ley to the permanent pasture—but they must be good pastures.

Fear of disease must not deter from developing an intensive enterprise. True, disease *is* a problem, and the adage that 'a sheep's worst enemy is another sheep' is true; but provided the many troubles are kept under control by good shepherding and by vaccinating, inoculating, worm drenching and treating for foot rot to modern veterinary requirements, and provided the shepherd ensures an adequate feed supply of the right quality at the right times, these difficulties are of much less significance than they were even a few years ago.

Building up the unit

It would be a rare event to undertake an intensive fat lamb enterprise *de novo*. More commonly a farmer who is thinking of such a policy is already running a flock on the usual type of pasture—one which may be capable of carrying about two ewes per acre and doing them and their lambs pretty well. The change-over to an intensive system is best spread over several years, and the increase in ewe numbers of from 50–100 a year can be linked with the establishment of from 15 to 20 acres of new high-producing pasture each year.

During the first three or four years of the build-up it is more reliable to establish the new leys by a direct reseed in June or July. Such a sowing will

Intensive grazing and trough feeding of ewes and lambs in spring

come into full production in its first year and should be capable of carrying six or more ewes and their lambs per acre.

To be able to do this, the ley should be sown with one of the recognized sheep grazing mixtures and the land fertilized according to soil tests which will approximate 3–4 cwt of a low nitrogen compound each spring. The pasture should be prevented from growing beyond three to four inches tall in the first autumn by grazing with lambs or with ewes at flushing time, and then be allowed to go into winter with around two inches of cover. After lambing it should be stocked with as many ewes and their lambs as will keep the herbage short throughout the spring and summer. No hay or silage should be taken in the first year. The returns from one field so treated will convince the farmer of the value of this treatment, and he is not likely to hesitate to treat subsequent fields in a like manner.

Pasture pride

When all the pastures devoted to the fat lamb enterprise are in a highly productive state, the flock will have been built up to the full unit and the scheme will be in full swing. Old permanent pastures or neglected leys cannot be expected to do a good job and have little place in the scheme. This demands that the farmer gives as much attention to the fertilizing and management of his pastures as he does to his arable crops. By reference to the Ministry's Bulletin No. 48, *Rations for Livestock*, he can calculate that the starch equivalent of the dry matter of different types of herbage can vary from as low as 43 to as high as 73. It is only pastures with a high S.E. which are suitable for the intensive enterprise. Good mixtures, regularly fertilized and closely grazed, will produce both quantity and quality. As this year has already reminded us, there are hazards of climate such as long cold winters, late springs, spring and summer droughts, and so on, but flock management must be flexible to meet these hazards. Reserves of hay or silage or trough feeding may be called for, or special forage crops may be grown in some systems. Set stocking or rotational paddock grazing are equally successful, and where greater refinement is desired some form of creep grazing for lambs can be introduced.

SUITABLE BASIC LEY MIXTURES
(to be modified to suit local conditions)

		lb	
One-year Ley:	*Italian ryegrass* Danish, S.22 or N.Z. Cert. H.I.	20-30	
One- to Three-year Ley:	*Italian ryegrass* Danish, S.22 or N.Z. Cert. H.I.	13	25 lb
	Perennial ryegrass S. 23, 4 lb + S. 101, 3 lb + S. 24, 3 lb or N.Z. Cert. M.S. 10 lb	10	
	White clover N.Z. Cert. M.S. or S. 100	2	
Three- to Six-year Ley:			
(a)	*Perennial ryegrass* S. 23, 7-10 lb + S. 101, 5-7 lb + S.24, 5-7 lb *or* N.Z. Cert. M.S. 17-24 lb	17-24	20-27 lb
	White clover N.Z. Cert. M.S. or S. 100	3	
(b)	*Timothy* S. 48, 2 lb + Omnia 3 lb	5	17 lb
	Meadow fescue S. 53, 2 lb + S. 215, 3 lb	5	
	Cocksfoot S. 143	4	
	White clover N.Z. Cert. M.S. or S. 100	3	

Seasonal feed supplies

In the management of an intensive enterprise the shepherd must plan ahead for adequate supplies of feed, especially during these critical periods of late pregnancy and early lactation. Once the spring flush of growth begins, the seasonal growth of grass of the required quality usually satisfies the ewes and lambs at the stocking rates suggested earlier; but in early spring pasture growth is often inadequate. Every shepherd recognizes the value of fresh, green nutritious grazing at this time to stimulate the milk flow of the ewes. Such grazing is one of the most important requirements of the ewe flock and it can be provided from one or other of the following:

New pasture sown the previous spring or autumn.

A special sowing of autumn 'green feed' such as rye and ryegrass after an early harvested corn crop.

An undersowing of Italian ryegrass in the previous corn crop.

From 15 to 20 acres of one or other of these 'green feed' crops, especially rested over the winter and liberally treated with both autumn and spring dressings of nitrogen (especially the last two), can usually be fitted into the rotation with little extra cost. The 'green feed' can be rationed to the flock

for two to three hours a day and, along with hay or silage and trough feeding, will bring the ewes to lambing in good condition. Such sowings will also enable the main feeding pastures to be rested over the critical early spring period until they are ready to take the ewes and lambs for the succeeding 12 to 16 weeks.

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A.L.S. RENT ENQUIRY

Farm Rents in 1962

FARM rents in England and Wales were up 8 per cent in 1962 on the previous year. This is revealed by the 1962 Agricultural Land Service's Rent Enquiry, covering a sample of estates consisting of over 30,000 farms and totalling 3½ million acres and County Council Smallholdings amounting to a further 400,000 acres. The average rent per acre of crops, grass and rough grazing in this sample was £2 13*s.* in October, 1961; by October, 1962, it had risen to £2 17*s.* 6*d.* This rise was rather smaller than that between October, 1960, and October, 1961, when the increase was of 5*s.* per acre, or 11½ per cent.

Variation in farm rents

That there is a great deal of variation in rents between county and county is well known, and even between neighbouring farms in the same county. Some idea of this variation was given in the September, 1962, issue of *Agriculture.*

This year, information about individual farm rents was made available from a number of estates in the sample, amounting in all to 4,500 farms with an acreage of ¾ million out of the total of 3½ million acres. This number

of farms is too small to produce reliable figures for particular counties but may be taken as a guide to the spread of rents in the country as a whole.

Percentage of farms in each country (sample of 4,500 farms)

	Rent per acre						
	0-19s.	*20-39s.*	*40-59s.*	*60-79s.*	*80-99s.*	*100s. and over*	*All*
England	3·0	9·5	26·0	31·5	17·0	13·0	100·0
Wales	9·5	28·5	26·5	18·0	8·0	9·5	100·0

The farms in the lowest rent groups are generally the larger ones, often having a fair amount of rough grazing. This is why the average rent per acre for the country as a whole is rather lower than the spread of rents would suggest.

In both countries—and this is true of most counties—there were a number of farms with rents of less than £1 per acre and others commanding over £5 per acre. In England and Wales as a whole four in every hundred farms were let at less than £1 per acre and as many as twelve in a hundred at more than £5 per acre.

Individual rent changes

The sample of 4,500 farms for which individual details were available had a slightly higher rent per acre and also a slightly greater increase in rent than was shown by the survey as a whole. In this smaller sample rents negotiated anew during the year, having been in most instances below the average for 1961, were higher (and in some instances considerably higher) than the average in 1962. These rents were looked at separately:

Average rents per acre by type of rent change (sample of 4,500 farms)

Type	% of sample farms	Oct. 1961	Oct. 1962	% increase
		£ s.	£ s.	
New tenancy				
—by tender	0·5	3 7	4 14	41
—by agreement	3·5	2 15	4 0	45
Sitting tenant				
—by agreement	28·5	2 11	3 6	29
—by arbitration	0·5	2 5	3 11	57
No change in rent	67·0	2 19	2 19	0
All sample farms	100·0	2 16	3 2	10

The farms let by tender during the year had the highest average rents before and after their rents were increased, though the percentage increase was no greater than was obtained on other new tenancies. One possible explanation of this is that the lower quality farms were less likely to be let by tender.

Rent increases to sitting tenants rarely went to arbitration. When this did occur the initial rent was lower and the final rent higher than rents increased by agreement. The sample confirms the common experience that the average rent increase to sitting tenants is lower than the average increase in rent on a new tenancy.

A comparison with figures from the 1961 enquiry shows the most significant change in the situation to have been that the average rent increase on new lettings in 1962 (just under 45 per cent) was substantially smaller than the increase (65 per cent) in 1961.

HOUSING MACHINES

How worth while is it?

M. C. Mathieson

Whether new housing for farm machines is justified as a capital investment is a problem facing an increasing number of farmers

WITH increasing agricultural mechanization, most farmers now have a formidable array of machines and implements. As a result, there is a lack of specialized storage accommodation on many farms, and we often see expensive modern machinery being stored under makeshift conditions—either in odd parts of farm buildings or left out in the open.

In such circumstances as these, access to any one machine may be difficult and facilities are generally poor for undercover repair and maintenance work. Inconvenience is a drawback which may be tolerated if it is offset by a reduction in costs. The question, therefore, is whether inadequate housing of farm machinery is an acceptable or a false economy at a time when machinery costs are an ever-mounting item in the farm budget and the purchase of new machines makes increasing inroads on limited capital resources. Do machines need fewer repairs and last longer if housed properly? Can the cost of a new implement shed be quickly recovered from the reduction in machinery costs resulting from better housing facilities?

The best housing policy is that which makes the greatest contribution to the efficient and profitable working of the farm. Each farmer will have to decide on the answer to this for himself in the light of his general circumstances and personal preferences. All that can be done here is to focus attention on some of the factors involved.

The depreciation question

Expenditure on machinery repairs, fuel and depreciation charges now average nearly 20 per cent of total costs on arable farms. Good housing can undoubtedly cut repair costs, and prolong the life of machinery. Proper

facilities for maintenance work, a farm workshop and a washing-down bay, could all be provided for in a specialized implement shed. These facilities would give the additional benefits of diminishing the risks of breakdowns and accidents and generally contribute to the smooth running of the farm; all at a price.

As far as repairs are concerned, similar results could be obtained by having relatively new equipment. By frequent trading-in for new models, it is possible to get a comparatively trouble-free set of farm machines—the first years of a machine's life are its best.

Does adequate housing make any great saving in depreciation charges? In so far as depreciation is caused by continual exposure to the weather, the answer is yes—especially with large and complicated machines such as combines and tractors. An American survey shows that the useful life of such machines can be halved if left out all the year round without protection. Simple implements such as harrows and rolls are much less vulnerable to the weather, while rust-preventive oils and tarpaulin can offer some degree of protection to machines with more complicated mechanisms. But it would need a strong nerve to leave a new £2,500 combine out in the open in all weathers, however carefully it was sheeted down.

Trade-in allowances

Depreciation caused by wear and tear in use and by technical and economic obsolescence obviously has little to do with housing. What is less certain is the effect of housing on trade-in allowances received for relatively new machines. Tractors, combines and balers are most often the kind of equipment subject to part exchange transactions; machines for which proper housing conditions are generally held to be essential. The level of second-hand allowances, however, depends more on model and age rather than mechanical condition. The state of the market is also important. Often to encourage large orders, hidden discounts on new machines are given in the form of high trade-in allowances on the old models. The machine in good condition ought to be worth more than a similar model in a poorer state, but the margin between them may not be great.

So as far as depreciation is concerned, good housing will, by prolonging the working life, reduce costs on farms where the machinery is kept for comparatively long periods. Where the general policy is to trade-in at frequent intervals, the effects of housing are rather divorced from the incidence of both depreciation and repair charges. The general tendency, of course, is for the smaller farmer to hang on to machinery for a number of years and for the larger man to trade-in after only a few years' use. The bigger farmer is also more likely to reap the benefits of hidden discounts on large orders for new machinery and to enjoy an income large enough to exploit the full possibilities of Inland Revenue allowances on machinery purchases.

Sinking capital

Yet it is on the larger farms, with their extensive complements of machinery, where the pressure would be greatest to erect specialized implement sheds. To sink capital into a new building on such holdings on the grounds that the cost will be recouped quickly from the savings secured in machinery expenses is a distinctly speculative business.

Specialized implement sheds are expensive. A popular type, a portal frame structure with cement asbestos sheeting, totally enclosed and concrete floored with sufficient headroom for a large combine, would cost from, say, 14*s.* to £1 per sq. foot of ground surface covered, according to site and the number of extras required. Capital costs can be reduced by using cheaper materials, but broadly speaking lower construction costs tend to go with higher annual maintenance charges. Other possibilities of reducing the initial capital outlay include the erection of lean-to sheds or other partially enclosed structures. These, of course, give less protection against the weather.

Storage requirements depend on the machinery complement, and this in turn is partly determined by farm size and the type of farming system followed. The Agricultural Land Service publishes tables in which storage space requirements in terms of per sq. feet of ground surface are quoted for individual machines and implements (see F.E.F. Leaflet No. 25, *The Implement Shed*). From such data, rough estimates of space requirements for individual farms can be drawn up.

Return on investment

An idea of the possible magnitude of the costs involved is given by taking the construction costs quoted earlier and relating them to a requirement figure of 1,500 sq. feet per 100 acres for a modest sized arable farm. This gives a capital outlay approaching £1,500 on an 100 acre arable holding. In addition, annual maintenance charges are incurred.

If a landlord erects such a building, he will expect a gross annual return of around 8 per cent on his capital. An investment of £1,500 might well lead to a rent increase of £120 a year. Where an occupier proposes to put up such a building himself, he should seriously consider whether his capital could be more profitably invested elsewhere. In all probability there are more lucrative forms of investment than the erection of a specialized item of fixed equipment on which the rate of return is rather problematic.

True, one-third of the cost of an approved project at present can be obtained through the Farm Improvement Scheme and tax concessions are available. But the other two-thirds of the capital have still to be found, and as far as tax allowances are concerned, the alternatives to building also benefit from the Inland Revenue. New machinery enjoys an investment allowance, while the whole, not part, of repair costs, can be offset against income for tax purposes.

A further reason for adopting a cautious approach to long-term investment in a specialized building is the rate of technical and economic change in the farming industry. Rapid technical developments affect both the type and design of machinery; and economic changes are inevitable. Some authorities even advocate that no specialized buildings should be erected unless there is clear evidence that the costs can be recovered within ten years. Implement sheds are unlikely to come into this category.

Why not multi-purpose buildings?

Rather than run the risk of being saddled with a future white elephant, farmers who must build, would be well advised to consider the possibilities of multi-purpose prefabricated structures. These buildings, with their emphasis on flexibility in use, are very much in the fashion. The whole or part of such

a building could be used as a machinery store with the advantages of generous headroom and space for manoeuvre. The added flexibility could cater for changes in the composition of machinery complements, and if necessary the whole structure could be adapted cheaply for a variety of other farm enterprises.

So to the farmer faced by a machinery housing crisis, the advice given here is to think very seriously before erecting any specialized machinery store. The savings in machinery costs secured by adequate housing are unlikely to cover the expenses of a new building. There are other ways of cutting down repair costs besides expensive housing, while the effect of storage standards on depreciation charges may not be so great as might be imagined. If a new building is essential, then the wiser policy would be to eschew the specialized building and explore instead the possibilities of a multi-purpose structure.

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The Ministry's Publications

Since the list published in the March, 1963, issue of *Agriculture* (p. 132) the following publications have been issued.

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Government Buildings, Block C, Tolcarne Drive, Pinner, Middlesex. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 6d.)

ADVISORY LEAFLETS

No. 115. Slugs and Snails (Revised)
No. 396. Rearing Chickens for Egg Production (Revised)
No. 492. Saw-toothed Grain Beetle (Revised)
No. 518. Lime in Horticulture (New)
No. 519. Milk Cooling on the Farm (New)

OTHER PUBLICATIONS

Technical Bulletin No. 11. Black Currant Varieties (New) 10*s.* (by post 10*s.* 6*d.*) Details are given of a new system of classification devised by the author while working at the National Fruit Trials at Wisley and Brogdale. A full explanation is given of the characters used for identification of all the distinct and main commercial varieties.

D. J. Clayton Jones

N.A.A.S., Wye, Kent

How good will your silage be?

SOON the voice of the silage-maker will be heard in the land. Over five million tons of this valuable feedingstuff are made every year in the United Kingdom, on large and small farms alike. But what kind of product will come out of the silo? How will it compare nutritionally with the crop that went in?

The nutritional key—dry matter

The feeding value of silage depends on the proportion of dry matter that it contains, and on the quality of such dry matter. The proportion of dry matter can vary from 15 to over 30 per cent. A rough assessment of it can be made by wringing a handful of silage. If no juice runs out the proportion of dry matter is more than 25 per cent: if the juice runs out readily the proportion is less than 20 per cent. Most rations which include silage are calculated on the basis that it contains 20 per cent dry matter. The amounts fed should be modified appropriately if the silage contains a different proportion. Thus, if the silage contains the normal 20 per cent of dry matter, and the recommended allowance is 50 lb a day, 40 lb would be enough if it contains 25 per cent of dry matter; as, for example, when it is wilted.

The proportion of dry matter in the silage should be as high as possible; because the higher it is, the more nutrition the animals gain from the same amount of it, and the more they tend to eat. This can be of great importance where animals are required to eat large amounts on self-feeding systems.

The quality of dry matter depends on the stage of growth at which the crop is cut and the fermentation which it undergoes subsequently. If the fermentation is satisfactory, quality can be classified as follows:

1st Quality: made from grass with only a few shooting heads, or grass just heading with a good proportion of clover. It contains enough protein for the production of 2–3 gallons of milk per day when suitably supplemented by hay and cereals.

2nd Quality: made from grass just heading, or fully headed with a good proportion of clover. Cows fed on it, with a suitable amount of hay and cereals, will produce up to a gallon of milk per day.

3rd Quality: made from fully mature herbage. This is a maintenance food only.

Colour and smell are your guides

Well-fermented silage is greenish-yellow or khaki in colour and has a sharp, acid smell, with a fruity background. If the silage is greenish-brown and has a vinegary smell with a rancid background smell which persists on the hands, the silage has undergone some secondary fermentation and is a little 'underheated', but not sufficiently so to affect its feeding value.

If the silage is olive green and smells very badly it is seriously 'underheated', reducing its quality assessment by one class. Putrid, slimy silage should, of course, never be fed.

Silage which has a yellowish-brown colour and a slight tobacco-like smell has been slightly overheated but not enough to alter its feeding value. But if it is light brown in colour and smells like tobacco, its feeding value will be much less, since the protein which it contains will be less digestible. The quality assessment for the silage should be reduced by one class. If the material is initially in the third class on the basis of maturity and the silage is overheated, it is merely a substitute for one-third of its weight of poor hay or straw. If the silage has a dark brown colour and a strong tobacco-like smell, it should be placed in the lowest class, irrespective of the maturity of the herbage put into the silo.

Rationing it out

Silage is best used when fed in properly planned rations. And before you can plan your rations you must find out how much silage is available for each class of stock and how good it is. If the quality of the silage differs from layer to layer, the better portions should go to milking cows and the poorer to the dry cows. In that case the amounts of each quality would have to be estimated and allocated separately.

You can find out the average weight of the silage per cubic foot by cutting out blocks of it from various places in the silo, and measuring and weighing them. The total weight of silage in lb can then be found by multiplying its volume, excluding waste material, in cubic feet by the weight of one cubic foot in lb. To give the approximate daily allowance for each animal, the total weight should be divided by the number of animals fed and the number or days for which they are to be fed. The rate of use should be checked both by weighing the amounts fed daily, and also by noting the rate at which the silo is being emptied.

Farming Cameo: Series 3

3. South Berkshire

J. C. Rankin

SOUTH BERKS is that part of the Royal County of Berkshire which lies west of Reading to the Wiltshire border beyond Hungerford and north from the Hampshire boundary to the Ridgeway, that ancient green tract which follows the crest of the downs from above the Thames at Streatley westward to beyond Lambourn.

The Kennet valley forms the main artery of the district, and on each side of the river is a belt of alluvium flanked by valley gravel. Years ago this alluvium was a network of what must have been very lucrative watermeadows until rising labour costs made the periodic 'drowning' uneconomic. During the last war A.E.C. machines and prisoner labour opened up hitherto silted ditches and stretches of the Kennet and its tributaries, so that hundreds of acres were reclaimed from semi-useless marsh, cropped and eventually reseeded.

The valley gravel soils which fringe the alluvium comprise mostly large flat fields. This is easy-working, early land, but with a rainfall of about 25 inches, crops are apt to burn in times of drought. Farm sizes vary throughout the valley, many being in the 300–400-acre group. Farmhouses are usually substantial, but the buildings are frequently outdated and much capital expenditure has been, and still is, necessary to bring them into line with modern standards. Some of the farms are County Council smallholdings. These were originally large farms which were acquired after the first world war and divided into 50-acre blocks, a system which has enabled many a young man to get a foot on the farming ladder and often graduate to larger farms. However, the holdings themselves usually present the same problem of inadequate and badly arranged buildings.

South of the Kennet the country rises to a ridge of plateau gravel merging with the Reading Beds before joining with Hampshire along the line of the Enborne valley. Agriculturally, this is a difficult area. It gives rise to a thin, stony soil, overlying tenacious clay which comes near the surface in many places, oozing water all the winter only to dry out like a desert in the early summer. Cobbett, on his journeys, frequently travelled this route and did not rate South Berks very highly when he recorded his *Rural Rides*, describing it as 'wretched country'. He wrote, 'I there saw such rascally heaths so that this villainous tract extends from East to West from Hounslow to Hungerford'.

Although some of these heaths still remain, today this 'villainous tract' contains many extremely sound and efficient farming units, in spite of a rather unfriendly soil. Land drainage is, however, a major problem and no easy task on land where soil types differ so frequently.

At the extreme south-east of the district is an area of more uniform heavy land overlying London Clay, whilst in the south-west corner the chalk rises sharply to 1,000 feet around Combe, with its gibbet dominating the hill.

North of the Kennet there is another belt of Plateau gravel and Reading Beds which extends eastwards towards the Thames before gradually climbing to the chalk downs. Two other streams, the Lambourn and the Pang, form valleys below the downs. The former is a narrow valley, but the latter is wider and similar in many respects to the Kennet. The farming of this land along and between the rivers forms a very consistent pattern. Dairying is the chief enterprise, and although all breeds are well represented, there has been a decided swing to black and white in recent years. Most farms are mixed with a fair proportion of other stock. The larger holdings usually grow a considerable acreage of corn and most are well equipped with machinery.

The chalk downs have in recent years become almost the Utopia of our modern age. Once frowned upon as being useless for anything other than sheep and training gallops, or perhaps a bail system of dairying, they have, with the coming of the combine drill and the fuller realization of the value of complete fertilizers, become the main corn-growing areas of the district. The soils vary from heavy clay with flint to thin chalk, whilst some of the higher land is capped with a black, puffy, sometimes acid soil. Here the farms are mostly large. Proctor barley and Cappelle wheat have certainly made their mark, and yields of 40 cwt to the acre are not uncommon. Herbage seed production also has its place on these farms and provides a useful and remunerative break from cereals. There is an air of prosperity about the downs these days, which is reflected by rising land values and the ever-increasing expanse of shining white asbestos, concrete and the latest machinery. Some suggest that over-cropping is taking place and is likely to act as a brake on production, but an even greater and more insidious danger may be over-capitalization.

Corn growing on the chalk is not new, but it used normally to be associated with hurdle sheep. However, 70 years ago one Berkshire farmer, the late George Baylis of Wyfield, pioneered a system of stockless farming. With slight modifications, this is still continued by his descendents on the same farms, which rather refutes any suggestion that livestock are essential in the maintenence of fertility. His rotation was a seven-year one, with four corn crops and two fallows pivoted around a one-year broad red clover ley. His farming enterprise grew in size even through the years of depression, and not a little of his success may have been due to the fact that he was sufficiently ahead of his time to use more artificial manure than many of his contemporaries. An earlier pioneer was Jethro Tull who, at Prosperous, near Hungerford, first developed and used his drill which revolutionized farming in after years.

In spite of Cobbett's scathing remarks and the district's variable soil types, the standard of farming in South Berkshire is high and the majority of its farmers are progressive and alert to new ideas. There can be no doubt that Reading, as a centre of agricultural activity, the University with its strong faculty of Agriculture, and other research and advisory bodies in the locality, must have had a considerable influence upon the farming of this area.

Agricultural Chemicals Approval Scheme

Additions to the 1963 List

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme. The Third List of Approved Products was published on 1st February, 1963.

INSECTICIDES

ALDRIN—*Dusts*

Soildrin—Pan Britannica Industries Ltd.

MALATHION—*Liquid Formulations*

Mi-Dox 60% Malathion—Midox Agricultural Division, Rentokil Laboratories Ltd.

FUNGICIDES

COPPER—*Soluble Powder Formulations*

For the treatment of soil to prevent damping-off of seedlings.

P.B.I. Cheshunt Compound—Pan Britannica Industries Ltd.

HERBICIDES

2, 4-DB WITH MCPA—*Potassium and Sodium Salt Formulations*

Mirvale Undersown D—Mirvale Chemical Co. Ltd.

DICHLORPROP—*Liquid Formulations*

Cleanacres 2, 4-DP—Cleanacres Ltd.

Mirvale Dichlorprop—Mirvale Chemical Co. Ltd.

MECOPROP WITH FENOPROP

A mixture of translocated herbicides for post-emergence use in cereals to control a range of broad-leaved annual and perennial weeds.

Potassium Salt Formulations

Longmates Mecopon—E. C. Longmates Ltd.

Amendments to 1963 List of Approved Products

The following amendments to the 1963 List of Approved Products published on 1st February, 1963, are also announced.

(a) DIAZINON PRODUCTS (page 27). The name of the firm appearing against the following products should read Murphy Chemical Company—*not* Fisons Pest Control:

Diazitol Atomizing Concentrate and Diazitol Liquid.

(*b*) FIRMS' NAMES AND ADDRESSES (page 112). The telephone numbers of the following firms should be amended to:

Boots Pure Drug Co. Ltd.—Nottingham 56111, Ext. 136

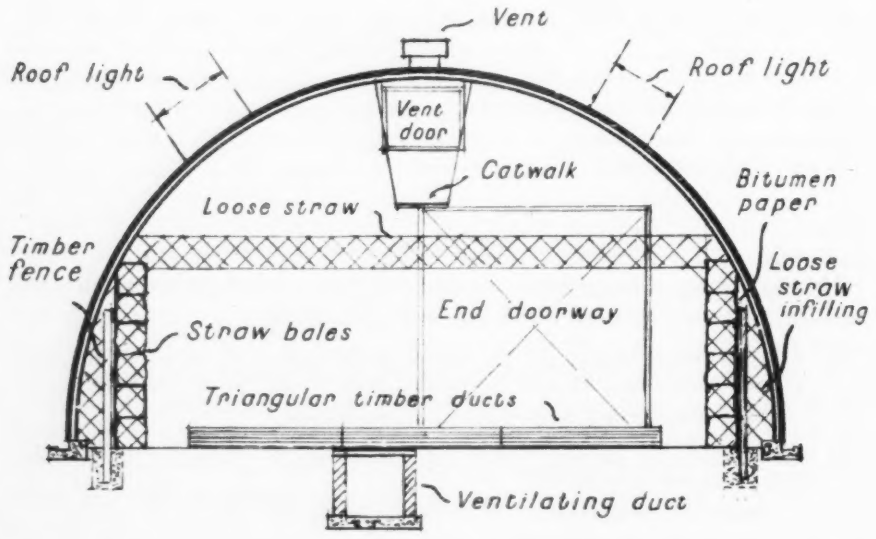
Cleanacres Ltd.—Cheltenham 21525

J. L. MOORE
Agricultural Land Service, Harrogate

A Low-cost Potato Store

FARMERS who stored potatoes in field clamps last winter will most likely have been wondering whether they will ever do so again. The way in which a farmer in the West Riding of Yorkshire gets the benefits of indoor storage from a low-cost building will certainly be of interest and value to them and to anybody else looking for a store which was cheap to erect and has proved itself by experience.

The farmer concerned grows around 500 tons of maincrop potatoes annually and wanted a building at low cost which could be erected by farm labour. The materials cost £1,250; the labour used on the erection would have had to be paid for anyway. Skilled labour was, of course, used for the electric wiring, as it should be.



The building is a half-round structure, commonly called 'Romney' type and is 144 ft long and 35 ft wide, with a maximum height of 17 feet. It is of steel frame construction and clad to foundation level with asbestos cement sheets. Sliding doors measuring 12 ft × 12 ft are sited at each gable end, which are part-boarded and part clad with corrugated iron. Straw bale walls, supported by a wooden post-and-rail fence, are erected on either side to a height of 11 ft, giving an internal width of 28 ft. Insulation is provided by one row of straw bales and a layer of bitumen paper sandwiched between the bales and the fence, together with loose straw packed between the straw wall and the external sheets of the building to prevent draughts.

A 3 ft × 3 ft central ventilating duct has been constructed with an external controllable opening at one end. The duct is covered with 3 in. timbers which can be removed to allow the triangular wooden slatted cross ducts to be positioned at 6 ft centres at filling time, and top ventilation is given by 4 ft × 3 ft doors at the gable peaks. The duct need not necessarily be central and, if it is not, it may be advantageous from the general purpose aspect.

Potatoes are stored to a depth of 9 ft, and this makes it unnecessary to install a ventilating fan. Roof lighting is by two translucent sheets in every other bay. A catwalk is suspended from the roof to give easy access to check the condition and temperature of the crop. The floor is of packed earth and is quite adequate, though a concrete floor would give the building greater versatility.

Grading is carried out steadily from December onwards, advantage being taken of all periods of hard weather to obtain higher prices, whilst riddling has been a comfortable job for the workers, even during the extreme cold experienced this winter. These conditions, coupled with adequate lighting over the sorting elevator, enable a higher standard of sorting and output. The 5-man gang in an 8-hour day is able to bag up 32–36 tons, which is about double the output of a clamp in the open.

Potatoes can be put up in advance of requirements without frost risk, and loading of merchants lorries in the store is a two-man job using an electrically-powered elevator.

Without intricate costing it would be difficult to give figures of the precise financial saving. But the farmer is well satisfied with his investment of about £4 per ton for a building which has allowed him to handle his potato crop efficiently and at the same time gives him the chance to use it for other purposes.

Bulk Handling on the Farm

Reported by ***Sylvia Laverton***

BULK handling and storage techniques, as applied in practice to four different commodities, were described by four speakers at the Farmers' Club on 13th March. MR. PETER GREGORY explained how, on Mr. Rex Patterson's farm, they reckon to save about 80*s*. per ton by storing their fertilizers in bulk on flat concrete floors and using a tractor-mounted front shovel to load the distributors—50*s*. due to bulk delivery and bulk handling and 30*s*. due to bulk storage. Using open hopper distributors of 45-cwt capacity, bulk handling increased the daily net output to 24 tons of fertilizer, as compared with 18 tons for manual loading. Three men took 20–25 minutes to fill the distributor from bags, whereas one man with the shovel took only 5 minutes—a 55-minute turn-round instead of 75 minutes.

A high, weatherproof Dutch barn, with 20-foot headroom for the tipping delivery truck, makes an admirable store. A lower building with 10-foot eaves, filled through the roof (from a ramp), might be cheaper to construct, though there remains the problem of making a weatherproof roof opening, operable by one man. On concrete floors, a sawdust layer appears to prevent slurry formation by hygroscopic nitrogen fertilizers in damp weather. Attempts last year to gravity-feed the distributors from a specially designed bulk bin filled from above, failed, due to the erratic flow characteristics of granular fertilizers. Free-flowing material could be loaded in 1½ minutes, but often the fertilizer formed a vertical wall; shovel loading then took 60 minutes.

MR. TREVOR ENSOR, who farms extensively in Leicestershire, has tried several systems for drying and storing bulk grain, starting in 1952 with bins, for which he acquired a great dislike—'they were ugly and costly and the single-purpose buildings occupy a lot of space when empty'. Also there were hold-ups at harvest time because not all the bins had drying facilities. Mr. Ensor believes that, once started, combining must never stop, because the potential yield of any acre decreases daily. He therefore turned to ventilated-floor storage, and now has a £6,000 building with 7,000 feet of floor area. It holds 1,000 tons of grain dried *in situ* by above-floor warm air ducts, which are removable to make it a general-purpose building. Grain straight from the harvest field is tipped on to the ducts, wet grain being placed next to dry, as shutters are used to direct the warm air where it is needed. This, he said, is the cheapest method, per ton, for drying and storing grain, requiring little labour or mechanical equipment.

The fan must be able to deliver air at 7 ft per min to the whole area, and air speed must not exceed 2,000 ft per min in any duct. Mr. Ensor stressed

that no matter how wet the grain, the drying air should not be more than 8 Fahrenheit degrees above ambient. Grain removal, by two 15-tons-an-hour augers suspended from the roof, has been criticized as difficult; otherwise no serious fault or difficulties have been experienced in five years' operation.

MR. JOHN GREEN, who directs farms in Lincolnshire for Mr. A. H. Worth, described a fully-mechanized bulk handling system for 230 acres of maincrop potatoes, evolved from careful investigations of equipment and methods for minimizing damage. Twenty-two men, using 11 tractors, 3 complete harvesters, 7 six-ton bulk carts with special tandem suspension that spreads the load evenly, and 2 elevators, can harvest up to 18 acres a day in a 15-ton per acre crop, and move the potatoes into store 2 miles away. Formerly, 30 man hours per acre were required. Now the average is 16, and on a good day less than 12. The capital cost is £30 per acre, or £45 including a 12-tons per hour grading line which, said Mr. Green, enables us to reap the sales advantage of quality potatoes. 'We have had many samples of potatoes which show no commercial damage, and only 20 per cent slight damage throughout.' The drama of para-cresol dipping for damage detection, and the persistence and success of foreman and mechanic in identifying and solving damage problems, have played their part in the success of the system.

Analysis of the damage caused by different soil-separation methods showed that carefully designed and operated harvesters would damage the potatoes less than hand picking into buckets and loading into trailers, and that handling in boxes would cost more and do more damage than the system chosen. The bulk carts and elevators have also been useful for piling beet into very large clamps ventilated by ducts beneath, thus reducing losses from heating, freezing and dirt tare.

MR. JOHN ALSTON is a milk producer, farming 2,500 acres in Norfolk. Adoption of new methods for bulk feeding and managing a dairy herd of 180 cows and calves, designed partly on the basis of experience gained in visiting the U.S.A., has enabled him to reduce the labour costs of milk production from 9*d.* per gallon to 3½*d.* Kept traditionally in cowsheds, the animals' annual output was 1,000 gallons per heifer, and 1,250 gallons per cow, obtained at an annual labour cost of approximately £40 per cow. This included allowances for holidays, insurance, and outside help—'which adds up astonishingly if time sheets are kept'—plus the cost of the cowmen's cottages. Using the new planned system of bulk handling feed, and parlour milking, the same quantity of milk is being produced by three cowmen—two on duty with slightly less outside help.

Bulk feeds—sugar beet tops, pea haulm silage, grass silage and some hay—are transferred by a fore-end loader into a feed hopper in the yard. This is a stationary self-emptying trailer, that teases out the feed on to a slat-type conveyor serving a 4-ft wide manger from which the cows feed on both sides. Concentrates can be fed via the hopper, but are normally given during milking, from adjustable metering feeders filled mechanically from a storage loft above. The cows' tails are labelled with coloured sellotape to simplify identification and rationing. 'Although we have grouped the straw at the sides of the yard, littering still takes a lot of labour' said Mr. Alston. 'As far as I know, this problem has not yet been solved.' Many of the cows had previously lived in one stall in the same shed all their lives, so the results achieved under the new system are remarkable evidence of the animals' great adaptability—and of the care the cowmen have given them.

Short Guide to the Annual Review, 1963

THE results of the 1963 Annual Review and Determination of Guarantees were published in a White Paper (Cmnd. 1968)* on 13th March.

A further substantial increase in agricultural net output is forecast for 1962/63 following a slight decline in 1961/62 from the level in 1960/61. On the new index introduced in 1960 (average of 1954/55 to 1956/57 = 100) net output for 1962/63 is forecast at 122 compared with revised figures of 117 for 1961/62 and 119 for 1960/61.

The cold spring of 1962 delayed germination but crop yields generally were high; production of wheat and barley was at a record level despite a difficult harvest. Marketings of cattle and sheep are expected to be much as in the previous year but there is a notable increase in pig marketings.

After the 1962 harvest, tillage operations made excellent progress but, due to the recent exceptionally severe weather, there have been losses of ewes and lambing prospects have suffered.

Actual net income is forecast at £408 million compared with the revised estimate for 1961/62 of £423½ million. Adjusted for normal weather conditions, the forecast for 1962/63 is £407 million compared with the revised estimate for 1961/62 of £413 million.

The net increase in costs is about £12½ million for Review commodities, mainly through increases in labour and rents, though there were substantial reductions in fertilizer costs and interest charges. On the other hand, the efficiency of the industry continues to improve and £25 million, as in previous years, is taken as an indication of the probable rise, on this account, in farm income.

The Exchequer cost in 1961/62 reached £342·6 million. In 1962/63 it is expected to be £321 million, but, on the basis of no change in the guarantees, the estimated cost in 1963/64 is a new high figure of £364 million.

Changes in guaranteed prices are shown in Table 3 (p. 198).

MILK. In recent years the pool price paid to producers has been continually reduced because each year the increase in production has been in excess of the increase in liquid consumption. Over the last two years. however, this excess has diminished. With production and liquid consumption appearing to fall more into line, and in view of the importance of milk to farm incomes, an increase of ½*d.* per gallon is thought to be justified and not calculated to stimulate a further increase in production—which would not be in the interests of the farmer or the nation.

CEREALS. The total acreage has increased in recent years. With continually rising yields, wheat and barley production has increased substantially over the past five years and the trend of market prices has been downward. The prices of wheat and barley are reduced by 5*d.* and 11*d.* per cwt respectively.

POTATOES. A further acreage increase is considered desirable and the guaranteed price is raised by 10*s.* per ton.

In addition to these price changes, certain other changes are made. To meet commercial requirements the maximum weights of fat cattle are reduced and the seasonal scales for fat cattle and sheep are adjusted to encourage a better pattern of marketing. The standard for young light weight fat cattle is revised. For fat pigs the arrangements for adjusting the guaranteed price according to changes in marketing forecasts are strengthened by extending the number of price adjustments; at the same time, in recognition of an increase in consumption, the basic guaranteed price is related to a higher level of forecast marketings. The stabilizing limits which relate to the guaranteed price are widened and the quality premium weight range is reduced.

New guarantee arrangements for hen eggs provide for deficiency payments to be the difference between the guaranteed price and an 'indicator' price of 3*s.* 2*d.* or the B.E.M.B.'s average market price whichever is the higher. The Board shares the excess when the indicator price is exceeded and bears an annually increasing proportion of any deficit between the market and indicator prices. Provision is made, subject to certain conditions, for increased Exchequer payments when imports rise above a prescribed norm.

The guaranteed price of sugar beet is now related to 16 per cent sugar content and the price differential is increased.

PRODUCTION GRANTS. The total annual subsidy on fertilizers is reduced by £2 million and the main ploughing grant is reduced from £7 to £5 per acre. Two new schemes are introduced: the Winter Keep Scheme and the Grassland Renovation Scheme.

*H.M. Stationery Office. Price 1*s.* 6*d.* (1*s.* 9*d.* by post).

The Government's determinations leave the total value of the guarantees virtually unchanged; under the Agriculture Act, 1957, a reduction of about £22½ million would have been possible.

The improvement in the arrangements for eggs and fatstock are a prelude to further changes which will be necessary in the development of the Government's agricultural policy. These are needed to bring the rising Exchequer cost under more effective control whilst still ensuring a fair standard of living for the agricultural community and maintaining a proper balance between home-grown and imported food.

Accordingly, during the months ahead, the Government will be discussing their proposals with the leaders of the industry and with Commonwealth and other countries who supply foodstuffs to this market.

Table 1

Estimated gross output of agriculture in the United Kingdom[1]
Years beginning 1st June

	£ *million*			£ *million*	
	1961/62	1962/63 forecast		1961/62	1962/63 forecast
TOTAL FARM CROPS[2]	287	310	TOTAL LIVESTOCK AND LIVESTOCK PRODUCTS	1,111	1,125
Wheat	60	84	Total fatstock	493	506
Barley	85	85	Cattle	237	235
Oats	10	10	Calves	5	5
Potatoes	86	84	Sheep and lambs	87	85
Sugar beet	33	33	Pigs	164	181
Hops	7	7	Milk and milk products	361	363
Other	6	6	Eggs[3]	164	161
TOTAL FRUIT, VEGETABLES AND FLOWERS	176	164	Poultry[4]	74	75
Fruit	53	49	Wool	17	17
Vegetables	94	84	Other	3	3
Flowers and nursery stock	29	30	CHANGE IN STOCKS[6]	+6	+6
OTHER OUTPUT[5]	31	35	TOTAL	1,612	1,640

[1]In Great Britain from holdings of over one acre only; in Northern Ireland one acre and over.
[2]Includes sales of crops for feed.
[3]For food and for hatching.
[4]For food and for stock.
[5]Includes deficiency payments for barley, oats and mixed corn not sold off farms.
[6]Value at market prices of changes in the volume of stocks and work in progress.

NOTE.—Because of rounding, sums of constituent items do not always coincide with totals as shown.

Table 2

Estimated farming net income in the United Kingdom
Years beginning 1st June

	£ *million*			£ *million*	
	1961/2	1962/3 forecast		1961/2	1962/3 forecast
FARMING NET INCOME	423·5	408			
TOTAL EXPENDITURE	1,339·5	1,384·5	TOTAL REVENUE[5]	1,763	1,792·5
Labour	298	301	Farm crops[5]	288	308
Rent and interest	116	121	Fatstock	492·5	506·5
Machinery:			Milk and milk products	360·5	363
Depreciation[1]	84	84	Eggs and poultry	238·5	236
Fuel and oil	50	48·5	Horticultural products	176	163·5
Other	94	96·5	Other products	51	55
Feedingstuffs[2]	382·5	406	Production grants and other credits	120·5	126·5
Fertilizers	120·5	123	Valuation change[6]	36	34
Seeds[3]	32	33·5			
Imported livestock[4]	62·5	67			
Other expenses	100	104			

[1]Estimated provision for machinery and vehicles, at replacement cost.
[2]Gross value of bought feed whether home-grown or imported.
[3]Imported seeds plus merchants' margins on home-grown seeds.
[4]Imported livestock plus transporting and merchanting changes on inter-farm sales of home-bred livestock.
[5]Estimates in Table 1 are here adjusted for changes in stocks awaiting sale. Includes receipts from sales of crops for feed.
[6]Increase in value at cost of stocks and work in progress.

Guaranteed Prices

Table 3

LIVESTOCK AND LIVESTOCK PRODUCTS

Commodity	(i) Guaranteed Prices 1962/63 determined after the Annual Review, 1962	(ii) Price change compared with the 1962 Annual Review Guarantee	(iii) Guaranteed Prices 1963/64 determined after the Annual Review, 1963
Fat Cattle (per live cwt) (*a*)	167*s.* 0*d.*	No change	167*s.* 0*d.*
Fat Sheep and Lambs (per lb estimated dressed carcass weight) (*a*)	3*s.* 2*d.*	No change	3*s.* 2*d.*
Fat Pigs (per score deadweight) (*a*) (*b*)	46*s.* 9*d.* related to a feed price of 27*s.* 9*d.* per cwt. On the basis of the current feed price of 25*s.* 11*d.* per cwt this guaranteed price is equivalent to 44*s.* 11*d.*	No change	44*s.* 11*d.* related to a feed price of 25*s.* 11*d.* per cwt.
Eggs—hen (per dozen) (*c*)	3*s.* 9·79*d.* related to a feed price of 26*s.* 7*d.* per cwt. On the basis of the current feed price of 25*s.* 1*d.* per cwt this guaranteed price is equivalent to 3*s.* 8·53*d.*	No change	3*s.* 8·53*d.* related to a feed price of 25*s.* 1*d.* per cwt.
Eggs—duck (per dozen) (*c*)	2*s.* 5·72*d.* related to a feed price of 26*s.* 7*d.* per cwt. On the basis of the current feed price of 25*s.* 1*d.* per cwt this guaranteed price is equivalent to 2*s.* 4·46*d.*	No change	2*s.* 4·46*d.* related to a feed price of 25*s.* 1*d.* per cwt.
Wool (per lb)	4*s.* 5·25*d.*	No change	4*s.* 5·25*d.*
Milk (average per gallon)	3*s.* 1·85*d.*	+ 0·5*d.*	3*s.* 2·35*d.*

CROPS

Commodity	(i) Guaranteed Prices for 1962 Harvest determined after the Annual Review, 1962	(ii) Price change compared with the 1962 Annual Review Guarantee	(iii) Guaranteed Prices for 1963 Harvest determined after the Annual Review, 1963
Wheat (per cwt) (*a*)	26*s.* 11*d.*	− 5*d.*	26*s.* 6*d.*
Barley (per cwt) (*d*)	27*s.* 7*d.*	− 11*d.*	26*s.* 8*d.*
Oats (per cwt)	27*s.* 5*d.*	No change	27*s.* 5*d.*
Rye (per cwt)	21*s.* 7*d.*	No change	21*s.* 7*d.*
Potatoes (per ton)	265*s.* 0*d.*	+ 10*s.* 0*d.*	275*s.* 0*d.*
Sugar Beet (per ton)	128*s.* 0*d.* related to 16·5 per cent sugar content. On the basis of 16·0 per cent sugar content and the new price differential this is equivalent to a guaranteed price of 124*s.* 8*d.*	No change	124*s.* 8*d.* related to 16·0 per cent sugar content.

NOTES ON PRICE TABLES

(*a*) The guaranteed prices for fat cattle, fat sheep and wheat are average prices subject to variation seasonally; the guarantee payments for fat cattle and some fat pigs are subject to variation according to quality; and the method of calculating fatstock guarantee payments involves an element of estimation. Because the marketings of fatstock and wheat cannot be accurately forecast, producers' average returns under the guarantees for those products in any year may be a little more or less than the guaranteed prices.

(*b*) The guaranteed price for pigs is subject to the flexible guarantee arrangement.

(*c*) The prices guaranteed to the British Egg Marketing Board for hen eggs are on the basis of the new guarantee arrangements. The basis of the guarantee arrangements for duck eggs will remain unchanged.

(*d*) The guaranteed price for barley is subject to arrangements whereby, to encourage a more even spread of marketings over the season, the deficiency payments are subject to premiums for barley delivered, after sale, in the later months of the cereal year and deductions for barley delivered in the early months of the year.

Meat Research Levy

STARTING on 1st April, a levy at the rate of 6*d.* a head on fat cattle, 1*d.* a head on fat pigs and ½*d.* a head on fat sheep will be imposed under the meat Industry (Scientific Research Levy) Order, 1963.

The levy will be collected by deduction from payments due under the Fatstock Guarantee Scheme, and it will apply to fatstock sold either by live weight or dead weight.

The levy will be divided equally between the parties to any sale of fatstock which immediately precedes its certification. The buyer will have to pay his half of the levy to the presenter at the time of the sale, and the full amount of the levy will then be deducted from the guarantee payment.

When fatstock is certified on the basis that it will be sold in the presenter's own butchery business, the presenter will have to meet the whole charge.

The levy will not be collected on pigs in England, Scotland and Wales, as this will be covered by a contribution from the Pig Industry Development Authority. The activities of the Authority do not extend to Northern Ireland, but the Pigs Marketing Board (Northern Ireland) which buys the majority of fat pigs in Northern Ireland has agreed to pay the full amount of the levy in respect of the pigs bought by the Board.

The levy on the small number of pigs sold otherwise than to the Board will be collected in the same way as the levy on fat cattle and sheep.

●The purpose of the levy is to provide a contribution by the meat industry towards the cost of the new Meat Research Institute which is about to be set up by the Agricultural Research Council at Langford, near Bristol. A note about this appeared in our May issue last year.

IN BRIEF

River Pollution

The Rivers (Prevention of Pollution) Act, 1961,* came into operation on 27th September, 1961. The Minister of Housing and Local Government has now fixed the 1st June, 1963, as the appointed day under the Act. By that date all persons, whether industrialists, local authorities, private individuals or farmers, from whose premises or works effluent enters any ditch, stream or river, must apply to the appropriate River Board for consent to continue existing discharges to which the Rivers (Prevention of Pollution) Act, 1951, did not apply. The application has to be made on forms available from River Boards and from most N.F.U. county offices. The forms require applicants to give details of the discharge.

Commenting on the Act, Mr. Eric Dunnett, Chairman of the N.F.U. Parliamentary Committee, said: 'This will affect a very large number of farmers. Their co-operation in helping to make Britain's rivers cleaner and purer is going to be essential, although we expect River Boards and their pollution prevention officers to deal with the large-scale, serious polluters first.

'Farmers must safeguard themselves by getting their consent application forms in before June 1st. Many will hear nothing further for months, even years, since River Boards will be too busy dealing with major offenders. If River Boards withhold consent, or attach unreasonable conditions, farmers can appeal to the Ministry of Housing.

'We have been assured by the Ministry that it is the Government's intention to secure a gradual and progressive campaign against river pollution, during which improvements will be closely related to what is reasonable and practicable. Conditions attached to River Board consents should not, in the Government's view, be technically impossible or economically prohibitive.

'We are working closely with River Boards and the Government advisory services to help farmers tackle the technical difficulties which can be expected to arise when, in the interests of securing cleaner rivers, plant or equipment needs to be installed on farmsteads.

'The N.F.U., which has long pressed the case for cleaner rivers and more effective measures to remove or limit serious pollution, accepts that farmers too must play their part. It is, however, going to be a long, slow job.'

Sugar-Beet Yellows after a Hard Winter

So far as one can foresee, a widespread early attack of virus yellows in sugar beet is unlikely in 1963. The stormy summer of 1962, cold autumn and long, severe winter have been unfavourable for the aphid vector of yellows virus.

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*Rivers (Prevention of Pollution) Act, 1951

Applications for consent to *new* discharges will, as hitherto, be made under Section 7 of the Rivers (Prevention of Pollution) Act, 1951, at the earliest possible preparatory stage, and in any case before the discharge is commenced. Fresh consents under the 1951 Act need to be obtained also where it is proposed to change an outlet into a stream or the nature or quantity of the effluent allowed in a previous consent.

Many of the brassica crops on which it normally lives during the winter have been killed by frost. Clamped mangolds have been in great demand for stock-feed, so that few will remain when sugar beet is sown. Thus few virus-carrying aphids will reach root crops from this source.

The hard weather has killed many sugar beet and mangold stecklings, and aphids will not have survived on them, as they can after mild winters. The past winter has provided an excellent cleaning process, but some virus sources and some aphids will remain.

A procedure for fumigating clamps with methyl bromide has been developed recently. Plans for a large-scale experiment to test it on farms have been abandoned because few clamps remain. Sugar-beet growers in East Anglia who have aphid-infested clamps after April and wish to co-operate in experiments on fumigation should write to Broom's Barn Experimental Station. The fumigation has been proved harmless to the mangolds and to stock that eat them; the questions to settle are whether the aphids can be killed with certainty on the farm and the cost and practicability of the method.

Whether sugar beet that was frozen in the ground last winter will grow and be a source of disease is problematical. Most plants will have been killed by frost, but odd ones may survive and yellows may well spread from them to young sugar-beet plants. Growers should ensure that unharvested roots not buried deeply are killed by cultivations or by herbicidal sprays, should they produce sprouts.

In 1962 aphids were late, but became numerous at the end of July, when stecklings sown in July had just brairded. Spraying with insecticides failed to prevent the stecklings from getting yellows, and more stecklings were infected than for many years. Should aphids infest seed crops next summer and produce winged progeny, they could spread yellows not only within the seed crops but also to root crops. Seed crops will be few, so it should be practical to keep them free from aphids. Warnings will be sent to seed firms if aphids start to infest seed crops, advising spraying with systemic insecticides. A single spray in June before the plants get too big may be enough; if later sprays are needed they must be applied with high clearance machines, or from the air.

In gardens and allotments and on weeds the aphids will have survived in two ways—as living insects on plants in sheltered places or glasshouses, on house-plants and on the shoots of stored roots and vegetables; and secondly, in the egg stage on *Prunus sp.*, especially peach. There is little the farmer can do about these sources. He must accept the fact that some aphids will reach his crops. By spraying with insecticide he can prevent heavy infestations building up, which may well happen quickly if the weather favours them. Weeds, wild beet or winter vegetables of *Beta sp.*, which often overwinter infected with yellow virus, are unlikely to be important sources of virus this year.

The virus sources mentioned above are those of the sugar-beet yellows virus. The sugar-beet *mild* yellowing virus, which has become increasingly prevalent in eastern England during recent years, may come from other, as yet unrecognized, hosts. The host range of this virus is being investigated.

It is probably inevitable that some aphids will carry yellows virus to young root crops each spring. Here the aphids multiply, spread the virus to patches of plants, and then winged aphids develop on the infected plants and spread the disease widely. The spray-warning scheme run by the sugar factories deals with this contingency. As soon as aphids infest crops and threaten to spread yellows, the factories advise growers to spray their crops with insecticide. This year's crop will be sown late, and as the disease spreads more rapidly in late-sown than in early-sown crops, spraying may be needed in some areas in spite of the salutary effect of the hard winter.

R. Hull, Broom's Barn Experimental Station,
Higham, Bury St. Edmunds, Suffolk

Books

The Energy Metabolism of Ruminants. K. L. BLAXTER. Hutchinson. 63*s*.

This is an outstanding book which should be read by anyone interested in the nutrition of ruminants.

The four sections deal with methods and techniques, the energy expenditures of ruminants, the utilization of the energy of food, and the practical application of experimental findings. With so much background information available, the author has made a valuable contribution in describing briefly and lucidly, the classical techniques and conceptions.

In this respect the chapters on energy expenditure are excellent. Many of the examples are new and taken from Dr. Blaxter's work at the Hannah Dairy Research Institute.

This is the first full-scale attempt to marry the classical theories of overall energy metabolism with the spectacular post-war advances in knowledge of the intermediary metabolism of ruminants. While the previous preoccupation with lipogenesis has been explained, there has been a bold approach to the far greater problems of determining energy expenditures in growth and lactation. Here again, the author can draw deeply on his own work. A complete chapter is devoted to a discussion of the significance of the fact that, with many ruminant diets, over two-thirds of the energy absorbed from the gut is in the form of volatile fatty acids.

It is claimed that the book is not primarily concerned with the practical problems of meeting the energy needs of stock. This is true, and the author has faithfully sailed the course marked by his almost traditional chapter headings; the basic principles of metabolism have been systematically unfolded.

But to the involved reader it is clear, with the inevitability and some of the suspense of a detective story, that Dr. Blaxter's sailing tactics aim at a nutritional victory. The first three sections of the book lead to a single conclusion: it cannot be assumed that the metabolizable energy (energy of the diet less the energy of faeces, urine, and expired methane) of ruminant diets is used with equal efficiency for maintenance, pregnancy, fattening, body growth, wool growth and lactation. It follows that single, additive indices of energy value cannot be ascribed to individual foods.

Having reached a conclusion which strikes at the basis of all the systems in use for determining the amounts of food necessary to satisfy the energy requirements of farm ruminants, it is a relief to find that the final section is devoted to a proposal for reform. This begins with a summary of the desiderata for a new system. It is then proposed, with examples but no details, that the unit of measurement should be the metabolizable energy, which would be worked out for each proposed diet. Allowances would then be made for the partition of the metabolizable energy according to the type of animal and its expected production, and for the form of the diet, in order to determine the adequacy of the diet. The system is somewhat laborious, and it is necessary to make a separate computation for each diet; individual foods cannot be substituted.

It is to be hoped that, since Dr. Blaxter has introduced his proposal as a general principle rather than as a detailed system, debate will be possible before the system is elaborated. One of the most attractive features of the proposal is that, as the necessity is proved, additional factors can be introduced into the expression dealing with the partition of the metabolizable energy. The success of this proposal may depend on the extent to which this flexibility can be maintained without loss of precision. If the choice of factors were to become a matter of judgment, as has happened in methods of converting digestible nutrients into starch equivalents, the system would become susceptible to bias. It must give a considerable improvement in precision if it is to compensate for the greater amount of work involved.

C.C.B.

Electricity in Modern Farming. FRANK E. ROWLAND. Land Books. 60*s*.

In writing this book, Mr. Rowland has drawn most successfully upon his own long experience of the subject. The result is a valuable contribution towards a wider dissemination of a vast amount of information regarding electricity and agriculture, which previously has been available only piecemeal from many different sources. Useful appendices and adequate references give the book added value.

The author has assumed that the reader has some technical knowledge or ability, as well as being familiar with agricultural husbandry generally. This should not, however, deter students and other young people from getting and studying this book. It will be of great interest and use to them, as well as to teachers and agricultural advisers everywhere.

The opening chapter covers an extremely wide range of subjects, but the author has in this, as in the rest of the book, taken great pains to explain them clearly. The chapter sets out the situation between the two great industries of agriculture and electricity and, at the same time, explains the function of electricity together with useful economics.

Installation and wiring are dealt with at length, but never, I am sure, with the intention of encouraging the principle of 'Do-it-yourself'. Emphasis is placed on the importance of correct installation and the employment of only properly trained wiremen and approved contractors or electrical engineers.

The next two chapters are devoted to the application of electricity—lighting and power (motors). In my opinion a great deal of technical information given in these two chapters requires careful study by the layman. It is obvious that expert assistance is required more in dealing with these two chapters than for any others. Incidentally, the only error I observed occurs on page 72, where the percentage sign should be deleted from the formula quoted.

The rest of the book is devoted to the very full and methodical presentation of information and calculations regarding the utilization of electricity in farming. In most cases sufficient information is given to constitute a guide to the practical installation of the necessary equipment, ranging from water pumping to milling, and from mixing and cubing to electric fencing. The author makes some detailed references to the possibilities of the heat pump in farm dairies; he also devoted a chapter to electric ploughing and cultivation. In view of the present-day use of electricity in and around farm buildings, coupled with the availability and cost of tractor (oil) power, the latter chapter is, to say the least, somewhat academic.

It should also be noted that several new and important developments concerning the use of electricity in agriculture have occurred since the author completed his script. This is, unfortunately, a hazard which apparently increases with the size and importance of the book. *R.A.B.*

Wires, Pipes, Pylons. The Country Landowners' Association.

It started with the railways, this invasion of the sanctity of land ownership. Now we can expect an extension of it with a country-wide network of underground pipelines. In between these two stages, owners have lived with a continuing and increasing invasion of their land by water pipes, sewers, gas pipes and electricity cables, both below and above ground.

The landowner of today has learned to live with the nation's needs. He no longer resorts to force to resist the 'invader', as did one Earl of Harborough, at Saxby in Leicestershire, less than a century ago—when he enlisted a company of locals to drive off by force the workmen of the Midland Railway Company.

But the landowner's acceptance of the nation's needs as paramount to his own does not mean he has no rights when another party proposes to carry out works on or under his land; for a person or authority can only enter on the land of another either with his express approval or with statutory authority. In the first case the owner has full control and can dictate his terms; in the latter, he has the protection of the Acts of Parliament under which the particular operator is proceeding.

It is at this point he becomes concerned—even bewildered—by the ways in which his land can be interfered with. As to compensation for damage or reduced value he is on his own; it is no part of the particular undertaker's duty to advise on or assess the compensation, but only to receive, challenge if they think fit, and finally meet the owner's claim.

Now, the owner can be well-informed at little cost. This admirable booklet sets out concisely the law and the owner's rights, backing up advice with a small but helpful collection of recent tribunal cases bearing on compensation. In addition there is a very useful *aide-memoire* of points for owners (and occupiers) to watch. There is information on rental scales for electricity pylons, and some valuable figures of agreed scales of compensation for oil pipelines.

A timely publication (how have owners managed without it for so long?), it should be in the hands of all owners and occupiers, and their agents too, for who can tell when or where the next 'invasion' will occur?

Copies can be obtained from the Country Landowners' Association, 7 Swallow Street, London, W.1. They are free to members of the C.L.A.; 5*s*. 6*d*. to non-members.

C.R.

Guns This Way. H. W. PEARSON-ROGERS. H. F. & G. Witherby. 42*s*.

How often, when we've finished the day's work, kicked off the dirty gumboots, washed off at least the worst of the grime, and sat down by the fire with a friend, do we fall to reminiscing? We look back over the past, not for any ulterior motive, not as a prelude to making plans for the future, but for the sheer delight of the thing. We talk not only about the job of farming but about all the other incidents that go to make up the countryman's life.

For those who enjoy shooting, it is not usually long before the conversation turns that way. The runner that no one could find until you put your dog in, the woodcock that flew right down the line and finally fell to the last gun. And from there to the nature of keepers, and dogs, and guns, and such-like things.

By common consent sportsmen are famed for their story-telling; and, next to fisherman, people who handle a gun come high on the list of those in whom the art of reminiscence is truly developed.

But such a pleasant pastime implies a friend to talk with. When he is not there, you will do a lot worse than reach down *Guns This Way* from your bookshelf. For this book is a mine of shooting reminiscences, drawn from six memorable shoots in the 1960-61 season from places as far apart as Yorkshire, Suffolk and North Wales.

Interspersed between the pages of the main story are a number of excerpts from various writings of the past on the same and kindred subjects; on loaders, on dogs, on poaching, on a famous shooting wager, and many more. These are taken mostly from *The Sporting Magazine* of a century and a quarter ago—far enough away to be of historical interest, and yet near enough to be for the most part topical.

The book is illustrated by a great number of fine photographs, some in colour, and by numerous, even finer, line drawings. The format and layout of the book match the story and its subject. It is generously presented on fine paper and is a pleasure to handle and read.

M.F.T.

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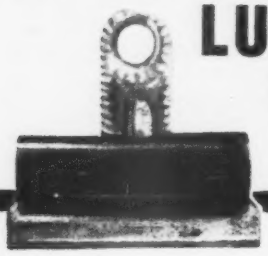

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